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Plant Industry Division

Annual Report 1988-89

Alberta
AGRICULTURE

Plant Industry Division

Annual Report

1988 - 89

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Highlights

HIGHLIGHTS

- A survey conducted on Alberta's bee population confirmed that tracheal mite, a very serious internal parasite of bees has reached the province. On a more positive note, a survey for the even more serious varroa mite did not find any of these pests in Alberta.

- Alberta continues steady progress towards becoming free of both diffuse and spotted knapweed. These weeds occupy millions of acres in both British Columbia and Montana. Alberta has reduced the infestation to scattered patches.

- The Russian wheat aphid, a very serious pest of most cereal crops, was identified in Alberta in the summer of 1988. This aphid has been moving steadily northward across the United States and its appearance here was anticipated. There is no way to stop the spread of Russian wheat aphid, so Alberta farmers are being advised of control techniques.

- A major effort to stem the advance of virulent blackleg of canola was initiated. Virulent blackleg has been spreading westward from initial infestations from Saskatchewan near Lloydminster. A government sponsored seed testing program ensured clean, disease free seed for the spring of 1989. The testing will be coupled with inspections and intensive extension efforts in the future.

- A leafy spurge control program utilizing sheep as biocontrol agents was successfully completed in the M.D. of Cardston. In addition, an introduced insect which controls leafy spurge has built up its population density in the Cardston area. In 1989, field collections will be made at the site and the insect will be introduced to other spurge infestations across the province.

- Alberta submitted approximately one third of the "minor use of pesticide" proposals for the entire country. Several have already received approval and others will be pursued. With Alberta's drive to diversify crop production many new pesticide registrations will be required. In the initital years of production, the acreage will be insufficient to stimulate private sector investment, so Alberta Agriculture will continue to be involved in this strategic area.

- The Honourable Peter Elzinga, Minister of Agriculture, proposed a major review of the federal pesticide regulatory system, at the Agriculture Ministers Conference in June, 1988. By September 1988, the Honourable Don Mazankowski announced a review of the entire system. The review will deal with registration, labelling competition in the industry and environmental and health matters.

- The pesticide industry began collecting one dollar for every container of pesticide sold in the province. This revenue will be used to fund a container disposal system.

- The chemical industry faces a major crisis with the discovery that weeds are able to quickly develop resistance to several new lines of chemical herbicides. The new products, all related to the chemistry in products like "Glean" and "Ally" were virtually miracle products when introduced about five years ago. It was expected this chemistry would provide viable weed control products into the next century. This is now in doubt and it may mean major adjustments. This is particularly tragic since several older products are currently under scrutiny from the occupational exposure standpoint.

- Registration was received for a new 2 row hulless barley. It will be named "Condor" and breeder seed will be distributed in the spring of 1989. The University of Alberta hog feeding trials have indicated when Condor hulless barley is used in the ration the soybean meal portion of the ration may be reduced by 11%.

- Forage associations continue to focus attention on the forage industry needs. Ten associations received $310,195.00 in grants during 1988-89 fiscal.

- Approximately 6000 tonnes of double compressed (densified) hay was sold into export markets. The Japanese have expressed increased interest for these bales but strict phytosanitary restrictions exist. New machines costing $250,000.00 - $300,000.00 are being developed for processing.

- The new "Alberta Silage Manual" was prepared and distributed. The province of Saskatchewan co-operated in the development of this publication.

- Research continued on the intercropping of winter and spring cereals to increase the duration of grazing.

- Seventy-seven co-op seed plants processed 30.4 million bushels of cereals and oilseeds. This represents about 75% of the seeded acreage for those crops.

- The division assisted 34 seed plants with upgrading grants totalling $364,021.00 as the province's 30% share cost agreement.

- A new seed co-op plant was built in Pincher Creek and was assisted with $265,000.00 in grants. The seed plant at Willingdon was replaced for a cost of $1.1 million and received $400,000.00 in grant assistance.

- Special crop acreage increased by about 10,000 acres to an estimated 410,000 acres in 1988. This is a four-fold increase since 1978. Approximately 1/2 of the acreage was devoted to field peas, dry beans, lentils, soybeans and faba beans with an estimated value of $70 million to Alberta's pulse growers.

- Alberta has approximately 20% of the pedigreed seed acreage in Canada. In 1988 there were 1,068 seed growers with 230,232 acres inspected.

- Field Crops Branch assisted Olds College in establishing the ground work for a new certificate/diploma course in seed and grain technology.

- Export sales of seed potatoes to USA markets continued to increase. Alberta Tree Nursery and Horticulture Centre is committed to developing more grower self-sufficiency in nuclear and pre-elite seed potato production.

- A dramatic reduction in demand for trees in 1988 was caused by the implementation of a charge for these trees. This reduction was short lived as demand for trees in 1989 has increased by 40 percent.

- Alberta Tree Nursery and Horticulture Centre has expanded its role in research, particularly in new and developing crops.

- During the crop production season Edmonton wholesalers purchased up to 70 percent of their produce from local vegetable producers.

- Land was purchased to establish a permanent sub-station at Bow Island. This sub-station will allow an intensification of crop diversification research.

- Winter protection (straw mulching) of Junebearer strawberries, dramatically increased yields as much as 50% at Brooks and 200% at Edmonton, over unmulched treatments.

- Field pea tests showed a number of breeding lines and cultivars that were earlier maturing and higher yielding than the standard commercial cultivars. Licensing data is being generated.

- Long term evaluation of perennial forages indicated that many standard cultivars are no longer the most productive. A seven year yield comparison showed "Mayak" russian wild-rye with a 17% greater yield than the check variety "Swift".

- Computerization and mobilization of the EM 38 salinity meter now allows for rapid salinity mapping of commercial fields and research plot areas.

- Carrot leathers and saskatoon leathers proved to be very acceptable products and offer potential as alternative markets for these projects.

- Glean (chlorsulfuron) applied at 2x the recommended rate in 1984, continued to damage alfalfa, lentils, potatoes and canola in 1988, although yields of alfalfa, potatoes and canola were not significantly different from the control.

- The minute pirate bug, a native species collected from Alberta alfalfa fields, proved to be a possible predator for the biological control of western flower thrips in commercial greenhouses; joint efforts of the Alberta Environmental Centre and Plant Industry Division in biological control of pests in greenhouses continues.

- Two seedlings developed through the Prairie Potato Breeding Program are receiving permanent licenses in Canada and will be named shortly. Alberta special crops and horticultural research center carries the Alberta responsibilities for this program.

Branch Activities

CROP PROTECTION BRANCH

Summary

The mission of the Branch is to protect Alberta's crops and agriculture from losses due to pests, through the development, implementation and adoption of economically justifiable, effective and environmentally sound pest management programs and strategies.

Our goals are:

- To keep Alberta free of pests by operating programs of exclusion and/or eradication of pests wherever this approach is possible and practical.

- To reduce the damage done by agricultural pests whenever exclusion or eradication is impossible or impractical.

In addition to responsibilities in pest control, the Branch also administers the Alberta apiculture program.

The Branch was reduced by two full-time positions in 1988. Staff consists of twenty six full-time positions plus seasonal help.

Regulatory responsibilities included the enforcement of the Bee, Weed Control and Agricultural Pests Acts. Extension education, preparation and packaging of technical information for delivery to field staff and farmers was a major activity.

Programs were operated to keep out Norway rat, diffuse knapweed, spotted knapweed, nodding thistle, Dutch elm disease, varroa and others.

Pests such as rabies, bacterial ring rot of potato, and virulent blackleg of canola were kept to low levels. Plans were laid to begin eradication of BRR in 1989.

New initiatives for 1988 included a seed testing program to detect virulent blackleg of canola and a survey program for tracheal mite of honeybee.

Research programs were based at four locations with field plots throughout the province. Control measures were tested on a variety of pests and crops with particular emphasis on pesticides, biological control agents, and resistant crop varieties.

Contingency plans for dealing with six specific pests were completed. Our aim is to develop a specific response plan for each pest named in the Agricultural Pests Act.

Honey production was maintained despite low prices and fewer colonies of bees. The industry operated with fewer beekeepers and fewer colonies, however, yields were exceptionally high. The Alberta Government provided financial assistance of $10.00 per colony and for those unable to obtain bees, assistance was provided at lower levels.

The pesticide regulatory review was announced by the federal government after the Honourable Peter Elzinga brought the issue up at the Agriculture Ministers Conference based on documentation compiled by the branch.

BRANCH ACTIVITIES

ENTOMOLOGY, PLANT PATHOLOGY AND APICULTURE SECTION

Responsibility for prevention and control of insects, plant diseases and pests of honey bee remains with the producer as designated in the Bee Act and Agricultural Pests Act. The section's purpose is to develop pest management strategies and programs that reduce losses to pests, improve pest management decision making, and reduce th environmental impact of pest management practices.

The Fairview Regional Crops Laboratory continued to provide a diagnostic service in plant pathology and entomology for Region 6. In 1988, 253 specimens were processed as compared to 353 the previous year. Fewer speciments from ornamental and non-agricultural origins were accepted in 1988, so more time could be spent on agricultural projects.

Plant disease and insect specimens submitted for diagnosis at the Olds Regional Crops Laboratory, numbered 70 and 60 respectively, in 1988.

TABLE I.
FAIRVIEW REGIONAL CROPS LABORATORY DIAGNOSTICS

Crop Category	No. of Disease Specimens		No. of Insect Specimens	
	1987	1988	1987	1988
Field Crops	51	65	17	18
Vegetables	46	20	8	5
Ornamentals	75	56	53	18
Shelterbelts	2	5	2	0
Fruits	0	5	7	0
Miscellaneous	8	1	84	60
Total	182	152	171	101

1. **Entomology**

a. Russian Wheat Aphid

Russian wheat aphid, a serious pest of cereals, was first detected in Canada in late July, 1988, when a few were found on late maturing spring cereals in southern Alberta. By October, Russian wheat aphid was widespread south of Highway #3. More than 30% of the plants were infested in many fields of winter wheat and fall rye.

Because of the potentially destructive consequences for Alberta's cereal industry, the Crop Protection Branch prepared a plan of action to control the pest. The plan outlines both short and long term strategies for control, identifies agencies and personnel who will deal with specific problems, and describes issues of public concern that may arise as a result of Russian wheat aphid infestations.

Considerable effort was made to inform farmers and government personnel about the damage this pest causes and control methods that are available.

Two 8.5 meter high aphid suction traps were installed at Lethbridge and Brooks and were operated from May through October to monitor the flying stage of the Russian wheat aphid. Another function of the trap was to develop an inventory of aphid pests of agricultural crops in Alberta.

b. Stink Bug Monitoring

Green stink bugs infested about 3,000 hectares of abandoned farm land on the Blackfoot Reserve, 40 kilometers southeast of Strathmore. Russian thistle, a host of stink bugs, was the most abundant plant species on this land. Large numbers of stink bugs matured and flew into surrounding farm land within a 16 kilometer radius in early July. All crops within the area were affected with damage distributed as identified in Table II.

TABLE II

Cereal	Total Hectares	Tonnes of Grain Lost
Red spring wheat	6,705	6,410
Duram wheat	809	572
Barley	525	399
Oats	127	93
Fall rye	112	34
Oilseed		
Canola	174	15

Alberta crop insurance investigators reported 8,451 hectares (20,883 acres) damaged and 7,521 tonnes of grain and oilseed lost. Seventy-nine fields suffered yield losses of from 5-100%. In excess of $90,000 was spent by farmers on insecticides and application. Some crops had to be sprayed several times because of reinvasion.

Adults fed on stems of cereals and caused sterile heads. They also fed on heads and pods of canola and caused shrunken and deformed seeds. Large numbers of stink bugs were in grain shipped to elevators, however, they caused no damage to stored grain.

Stink bug populations will continue to be monitored in 1989 but damage will probably be negligible or minimal.

c. Cutworm Monitoring

This year marked the fourth year of an Alberta Agriculture/ Agriculture Canada program to obtain baseline population data using pheromone traps. District agriculturists and entomologists set pheromone traps to attract each of the target pest species.

Bertha armyworm - populations increased slightly at most locations with the exception of Strathmore where the catch increased to the point where damage could have occurred in 1988. Bertha armyworm

larvae were abundant in some fields of canola southeast of Calgary. These fields were also infested with diamondback larvae and were sprayed to control the diamondbacks. Insecticide application for diamondbacks was widespread and may have inadvertently delayed the resurgence of bertha armyworm in some areas.

Pale western cutworm - populations increased, but are still low except near Three Hills and Vegreville.

Redbacked cutworm - populations declined at most locations. Darksided cutworm is sometimes a pest in gardens and occasionally in crops together with redbacked cutworm.

Clover cutworms - were quite common in some mustard and canola fields particularly fields with broad-leaved weeds, but little damage resulted. Numbers of moths in sex attractant traps were the highest obtained since 1978 when the monitoring program began. Numbers of clover cutworm moths per trap in 1988 were almost twice as high as any previous year.

The average number of moths caught per monitoring trap is identified in Table III.

d. Grasshoppers

Grasshopper numbers and the resulting crop damage in 1988 continued to decline for the third consecutive year. Decreased grasshopper numbers were not attributed to disease. The fungus, Entomophaga grylli increased its distribution and prevalence but caused mortality in less than 5% of grasshoppers. The effects of weather on reproduction and hatching success probably caused the population decline. The infestation began when unusually warm, dry late

TABLE III

ALBERTA CUTWORM SURVEILLANCE MONITORING PROGRAM 1985-1988
(Average number of moths caught per monitoring trap)

	Bertha armyworm				Pale Western cutworm				Redbacked cutworm				Darksided cutworm			
Location	85	86	87	88	85	86	87	88	85	86	87	88	85	86	87	88
Barrhead	37	-	7	10	-	1	0	-	-	546	212	-	-	1	0	-
Brooks	97	38	31	64	463	213	130	142	2022	1414	1150	440	417	241	629	441
Falher	-	11	16	-	0	0	-	0	164	1273	-	468	0	0	-	0
Fairview	-	25	26	-	0	0	0	-	371	1866	2532	-	0	0	0	-
Hanna	12	-	19	22	389	-	158	239	314	-	1594	535	153	-	527	640
Lethbridge	7	4	6	6	1320	754	282	304	2163	1873	969	1010	1791	1246	952	625
Oyen	-	-	-	-	980	961	-	135	558	322	-	194	263	175	-	192
Stony Plain	25	-	16	51	6	-	0	0	562	-	200	227	0	-	0	-
Strathmore	17	27	46	250	573	646	-	112	1592	502	-	630	495	215	-	322
Three Hills	5	-	29	-	788	-	247	742	1791	-	1045	774	681	-	-	-
Vegreville	45	20	9	42	382	128	434	599	3055	2925	2418	1084	83	33	12	11
Manning	-	-	-	-	-	-	-	0	-	-	-	178	-	-	-	-
Wainwright	-	-	-	47	-	-	-	203	-	-	-	472	-	-	-	186

summers (1983-84) permitted high reproductive rates. The drought of 1988 was primarily an early season event that did not enhance grasshopper populations.

A new computer program has been adopted for insect pest surveillance and grasshopper population forecast. It provides greater precision and flexibility to forecast distribution and abundance of grasshoppers and has reduced the time required to summarize data and make predictions. It replaces methods based on maps assembled by hand or by simpler computer-mapping programs. Production of the forecast map (Figure I) has been reduced from three weeks to a day or two. The new system allows incorporation of mathematical models of the effects of the environment on the rate of change of insect numbers. It rapidly maps survey data, the extent of producers' efforts to control grasshoppers and the predictions of pest population density for the coming year.

The forecast for 1989 (Table IV) indicates scattered low to moderate infestations, except in some southwestern counties. Some areas, notably near Cardston still have severe infestations that could increase if spring and summer weather is warm and dry.

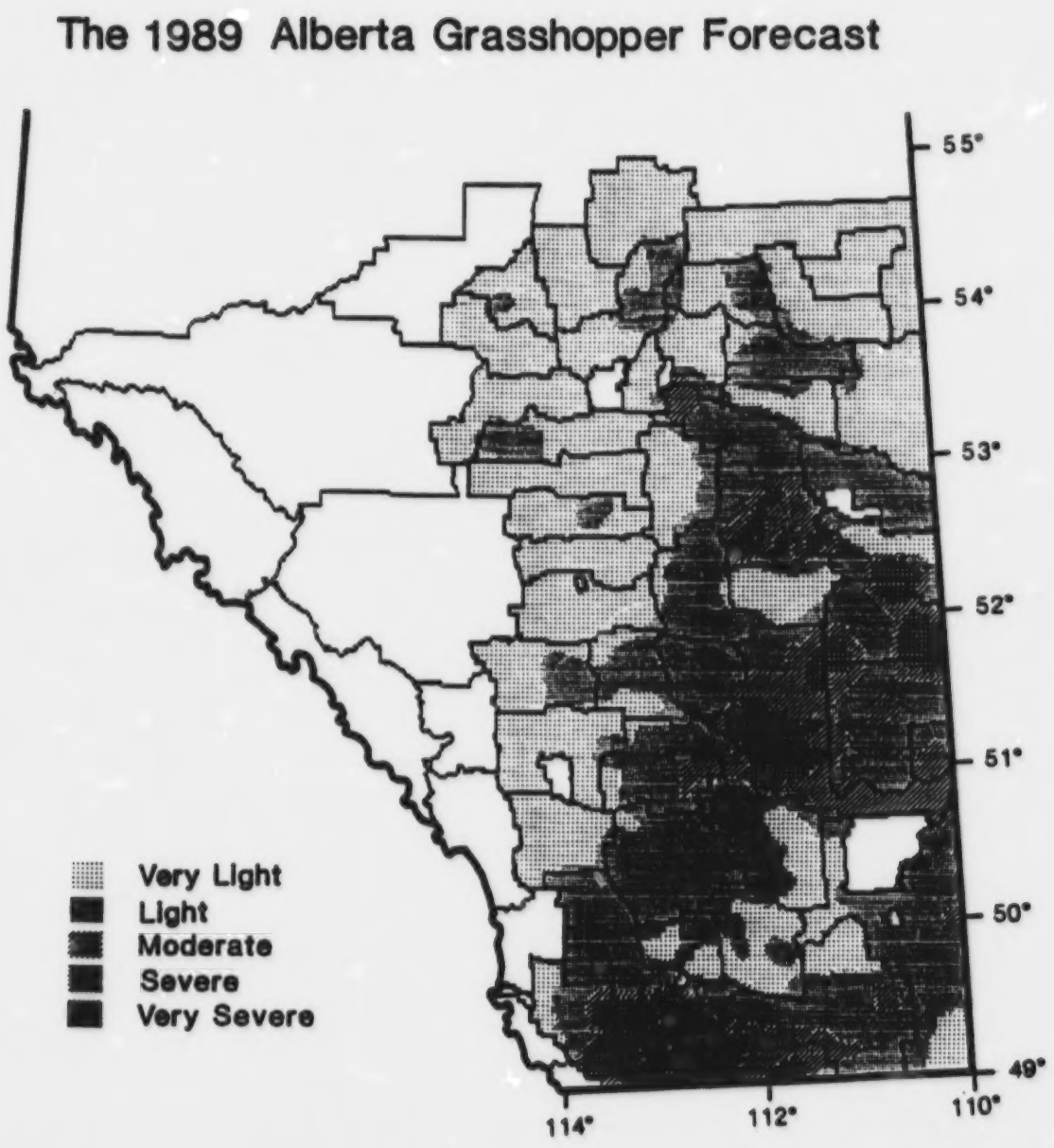
TABLE IV

FORECAST RISK OF GRASSHOPPER INFESTATIONS IN 1989 *

Legend	Area (%)	Area (km^2)
Very light	44	84,720
Light	40	77,190
Moderate	8	15,670
Severe	7	12,590
Very severe	1	890
	100	191,060

*Based on breeding densities in 1988.

FIGURE I


The 1989 Alberta Grasshopper Forecast
55°
54°
53°
52°
51°
50°
49°
114°
112°
110°
Very Light
Light
Moderate
Severe
Very Severe

e. Diamondback Moth

Larvae of the diamondback moth infested most fields of canola and mustard in southern Alberta. South of Highway #1 about 37,000 hectares were sprayed with insecticides. Treatment costs plus crop losses were about $3,750,000.

f. Brown Wheat Mite

High populations of brown wheat mite, Petrobia latens, occurred early in the spring in most fields of winter wheat that were recropped on cereal stubble. Heavily infested fields exhibited yellowing and exacerbation of drought symptoms. Because severe drought made the economics of control marginal, only about 1000 hectares were treated with insecticide. Some fields of recropped or continuously cropped dryland barley were also infested.

g. Cereal Aphids

Rose-grass, corn leaf, English grain were common in irrigated fields of wheat and barley that were late seeded. A few heavily infested fields of barley were sprayed. Cover crop and volunteer barley were severely affected by barley yellow dwarf virus following infection by corn leaf aphid.

h. Cutworms

Caused very little damage in 1988. Army cutworms were abundant in some fields of winter wheat and fall rye in early spring but only a few fields required chemical control. A greater problem is expected in 1989.

i. Wheat Curl Mite

Infestatations of seedling winter wheat were less prevalent in 1988 than in 1987. The wheat curl mite is the vector of the viral disease, wheat streak mosaic, which caused more damage in southern Alberta in 1988 than it has for some years. Wheat streak mosaic is likely to be most serious when populations of wheat curl mite have increased in seedling winter wheat the previous fall.

j. Lygus Bugs and False Chinch Bugs

These bugs were common in fields of mustard seeded late in the season.

k. Potato Aphid

Some irrigated fields of flax had moderate to high populations but only a few fields were sprayed.

l. Research on Silvertop of Fescue

An application of Decis 5.0 EC in the shot blade stage controlled plant bug type silvertop damage in two creeping red fescue fields near Fairview. Silvertop damage on treated and control plots was reduced from 38 to 2 percent in one field and from 8 to less than 1 percent in another field.

Plant bugs suspected of causing silvertop are Capsus cinctus, Stenodema vicina, Stenodema trispinosa, and Irigonotylus coelestialium. In the field with 38 percent silvertop, the insecticide caused a significant reduction of C. cinctus nymphs and a subsequent decrease in adults for 29 days. A reduction in S. vicina and S. trispinosa adults was found 11 days after plots were sprayed. There was a subsequent reduction in Stenodema spp. nymphs 52 days post-treatment. Irigonotylus coelestialium nymphs were reduced in numbers in sprayed plots 11 days post-spray. Numbers of plant bugs collected in the other field were too low to determine the impact of the spray. Nymphs of the predatory damsel bugs, Nabis alternatus and Nabicula americolimbatus, were detrimentally affected by the insecticide in both fields.

Capsus cinctus nymphs caged on pre-heading to early heading fescue appeared to cause damage to the seed head by preventing proper spikelet formation. Damage appeared to increase on developing seed heads when the number of nymphs was increased from one to four per head. Adults of the same species did not cause noticeable damage in the flowering and green seed stages.

2. Apiculture

a. Inspections and Surveys of Honeybees

A total of 4,147 colonies were inspected for honeybee diseases in 1988. American foulbrood was detected in 55 colonies, and 127 colonies were found with chalkbrood disease.

In cooperation with Agriculture Canada, a varroa mite survey was conducted on 1,640 colonies. Varroa is a serious pest of the honey bee that attacks and kills brood.

During 1988, bee samples were collected from approximately 1,100 colonies and analysed for the presence of tracheal mites. No mites were found. In January 1989, a survey of 1,500 colonies from two beekeeping operations at Fairview detected tracheal mites in 8 colonies. In February 1989, a province-wide survey of 10,000 colonies from 40 beekeeping operations was initiated to determine the distribution of the tracheal mite in Alberta. An additional six beekeeping operations have been found infested during March and April, 1989. All are located in the Peace River region. Tracheal mite is a serious pest of honey bees and increases mortality during periods of stress.

The Alberta Beekeepers Association voted in opposition to mandatory depopulation of mite-infested beekeeping operations as a control option.

b. Alberta Beekeeper Disaster Assistance Program

Alberta Agriculture provided assistance to beekeepers through the Alberta Beekeeper Disaster Assistance Program. Payments were $10 for each colony operated in 1988. Beekeepers unable to obtain bees in 1988 were paid $5 for each colony they operated in 1987. Payments totalled $1,871,815.

c. Apiculture Registration

The registration system was revised and updated to reflect more closely the true size of the industry. During 1988, 1066

beekeepers with about 187,000 colonies were registered in Alberta (Graph I). Approximately 155,000 of those colonies were operated for honey production. The remainder were for the production of bees for restocking purposes. This new operation became necessary due to the ban on importation of beestock from the United States (Graph II).

d. Honey Production

The 1988 crop year was above normal for all regions in Alberta (Graph III). The average yield per colony was estimated at 79 kg compared to the five-year average of 59 kg. An estimated 155,000 colonies produced approximately 12,000 metric tonnes of honey (Graph IV). Subsidization of honey in the United States has continued to depress the price of honey in Canada with an average price of $0.95/kg during 1988.

An estimated 165,000 colonies were overwintered during 1988-1989, however severe winter mortality occurred with an estimated loss of 28%.

e. Queen Bee Production

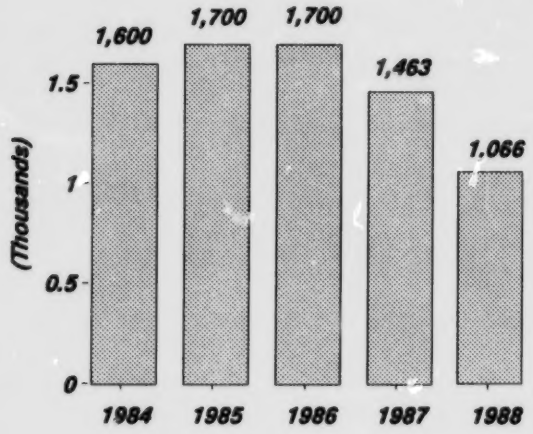
Commercial queen production increased substantially in 1988. An estimated 18,000 mated queens were raised and sold in Alberta, compared to approximately 8,000 in 1987. In 1988, an additional 10,000 queen cells were produced and sold.

In anticipation of future growth, queen producers formed a queen breeders association. The commercial production of beestock in Alberta offers an opportunity for diversification from honey production, although future prospects may be hampered by tracheal mite infestations.

Alberta Beekeeping Statistics, 1984-88

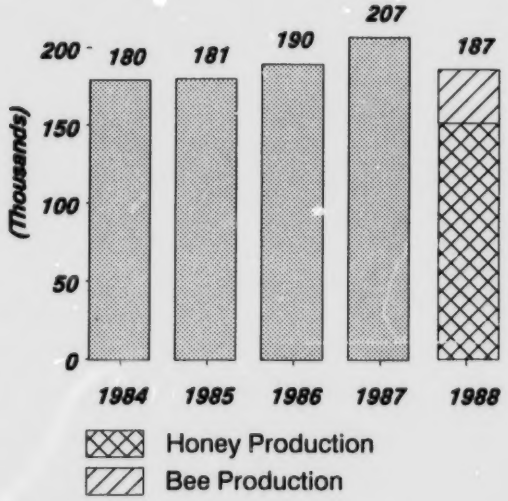
Graph I

Number of Registered Beekeepers



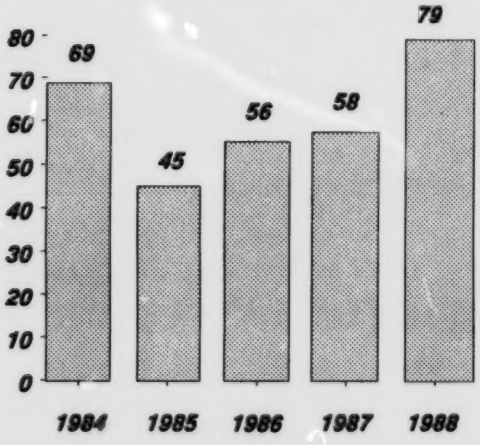
Graph II

Number of Operated Colonies



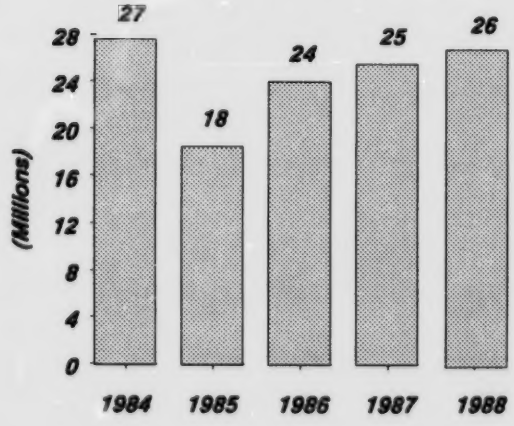
Graph III

Alberta Honey Average Yield
(kg/Colony)



Graph IV

Alberta Honey Production
(Millions of Pounds)



3. Plant Pathology

a. Bacterial Ring Rot Program (BRR)

All commercial potato fields of 5 acres or more were inspected for BRR. BRR was detected in the Counties of Newell, Forty Mile and Lethbridge and the Municipal District of Taber. One hundred fifty-seven potato growers were inspected with a total of 22,837 acres; 4% of the farms and 2% of the potato acreage were infected with BRR (Table V).

TABLE V

POTATO ACREAGE AND INCIDENCE OF BRR IN ALBERTA - 1988

District	No. of Farms		Acreage	
	Inspected	Infested	Inspected	Infested
M.D. of Sturgeon #90	14	0	2,065	0
Co. of Parkland #31	3	0	919	0
Edmonton Perimeter	5	0	289	0
Co. of Newell #4	14	3	3,233	430
M.D. of Cypress #1	2	0	34	0
M.D. of Taber #14	39	1	12,375	65
Co. of Forty Mile #8	9	1	727	25
Co. of Lethbridge #26	12	0	954	0
Lethbridge Perimeter	8	1	87	2
Region 6 (Peace River Area)	7	0	204	0
Region 5 (Barrhead Area)	5	0	150	0
Region 4 (Vermilion Area)	14	0	769	0
Region 3 (Red Deer Area)	15	0	775	0
Region 2 (Airdrie Area)	10	0	256	0
TOTALS	157	6	22,837	522

b. Dutch Elm Disease Control Program

Alberta continues to remain free of Dutch elm disease.

Responsibility for this program has been shifted from Crop Protection to Alberta Special Crops and Horticulture Research Centre.

c. Diseases of Cereals

In 1986, the first confirmed case of eyespot was reported in barley fields from central Alberta to the Peace River Region. This disease causes significant yield losses in Europe and parts of the United States. The disease is usually a problem in winter cereals and could pose a serious problem to their expansion. The potential impact of this disease and the management strategies to combat it will be determined.

No diseases of any consequence were reported for winter wheat and fall rye. The only diseases of any consequences for spring wheat in east central Alberta were common root rot and aphid transmitted barley yellow-dwarf virus.

Semi-dwarf barleys (Winchester, Jackson and Samson) were frequently infected with 2 to 10% loose smut, and emphasize the need for systemic seed treatments of these susceptible varieties.

Incidence of scald, a foliar disease normally found on barley in central Alberta, was low, presumably as a consequence of unusually warm growing conditions during June and July. Net blotch, a foliar disease of barley in south-central Alberta, was frequent and severe near Edmonton and Camrose.

Melanosis of spring wheat was extensive in west-central Alberta. Melanosis is a deficiency of available soil copper and symptoms are browning and distortion of heads, extensive tillering, weak straw and severe yield loss. The severity of this disease may be related to the unusual soil moisture conditions in 1988. Barley and oat fields are also significantly affected by soil copper deficiency but to a lesser extent then wheat. Rye appears relatively immune to melanosis. Adding copper to the soil controls melanosis and increases wheat yields in affected soils by up to 100% and more. Many thousands of acres all over Alberta may be deficient in copper, based on diagnoses of melanosis in wheat.

d. Diseases of Oilseeds

Over 3 million acres of canola were grown in Alberta in 1988. Virulent blackleg of canola caused significant yield losses in a few fields for the first time. Severely affected fields were near Viking, Sedgewick and Paradise Valley. Yield losses ranged up to 60%. Province wide losses from this disease are still at minor levels.

A disease survey was conducted on 115 canola fields in Region 6. The root rot complex was in all fields. Avirulent blackleg occurred in 17% of the fields. No virulent blackleg was found.

Virulent blackleg of canola could spread throughout Alberta and cause significant yield losses. Consequently, a "Blackleg of Canola - Response Plan" was developed by Alberta Agriculture in cooperation with federal and municipal governments and the canola industry. This plan identifies measures to eradicate or control virulent blackleg of canola. Alberta Agriculture initiated a program to pay for testing for virulent seed-borne blackleg of all canola seed intended for planting in 1989. This test is conducted free of charge on all seed samples submitted for germination testing. About 2,100 canola seed samples were tested via private laboratories. No virulent blackleg has been found.

Weather conditions in late June were favorable for sclerotinia white stem rot of canola for the first time since 1982. Dry winds in early July and low inoculum (disease) potential prevented a major outbreak, but fields with up to 10% infection were common by early August. Continued heavy rains in early August caused sclerotinia "hot spots" in lodged stands of Westar Canola. The fungus moves from plant to plant when leaves and stems are in close contact in lodged stands.

Moderate to high levels of Alternaria blackspot were common in west-central Alberta and the Peace region, particularly on Tobin

canola. Direct losses from this disease are not high but indirect losses from pod shatter in the swath ranged up to 20% (Table VI).

Tobin canola is losing its resistance to staghead (white rust); fields with 5 to 10% staghead infections are not unusual. Infection rates of Tobin are now comparable to Candle and Torch.

TABLE VI

PREVALENCE AND INCIDENCE OF DISEASES OF CANOLA IN PEACE RIVER REGION - 1988

Disease	% Fields Infected	% Plants Infected
Root rot (Rhizoctonia, Pythium, Fusarium)	100	99
Black Spot (Alternaria spp.)	97	49
Foot Rot (Rhizoctonia, Fusarium)	84	28
Sclerotinia (Sclerotinia sclerotiorum)	35	5
Avirulent Blackleg (Leptosphaeria maculans)	17	1

e. Virulent Blackleg of Canola Survey

Two surveys for virulent blackleg of canola were conducted. Plant pathologists surveyed one field for every 20,000 acres planted. Agricultural Fieldmen surveyed one canola field for every 5,000 acres grown in their respective municipalities. In total 979 fields were checked (Tables VII and VIII).

TABLE VII

VIRULENT BLACKLEG OF CANOLA IN ALBERTA - 1988

Crop District	General Area	Acreage (Thousands)	No. of Fields	% Fields With Blackleg
1, 4	Southeast	36	13	0
2, 5	South-central	282	14	0
3, 6, 9	Foothills	207	11	0
7	Sedgwick	494	24	11
8, 11	Red Deer, Edm.	335	18	0
10	Vegreville	661	37	33
12, 13, 14	North-central	279	11	0
15	Peace River	1,241	120	0

TABLE VIII

MUNICIPALITIES WHERE VIRULENT BLACKLEG OF CANOLA WAS CONFIRMED

Locality	Number of Fields Surveyed	Number of Fields With Virulent Blackleg
County of Flagstaff #29	35	5
County of Minburn #27	20	5
County of Paintearth #18	10	1
M.D. of Provost #52	2	2
M.D. of Wainwright #61	10	2
County of Vermilion River #24	19	2

f. Diseases of Field Peas

Personnel from the Crop Protection Branch and Region 5 cooperated to determine the effects of fungicidal seed treatments and seed-borne Ascochyta leaf spot of peas. Seed treatment had little or no effect on pea diseases; seed-borne Ascochyta had no effect on pea establishment, germination or yield. Root diseases increased and yields decreased when field peas were grown in the same fields in successive years. Peas grown on pea stubble had 10% infection rates of Pythium shoot blight on the variety Tipu. Downy mildew, an extremely destructive soil-borne disease of peas was present on

4 and 10% of SS7 and Tipu varieties, respectively. The presence of both diseases demonstrates the need for a strict adherence to a 4 year rotation if field peas are to become an established crop in Alberta.

g. Research in Plant Pathology

- Evaluation of rates and combinations of nitrogen, phosphorus and potassium and their effects on stand establishment, yields and root rot of canola.

  Stand establishment was increased by high rates of nitrogen and phosphorus but did not respond to potassium carbonate fertilizer. High and moderate rates of nitrogen and phosphorus increased yields of Tobin canola. Yields did not increase in response to potassium.

  Root rot was prevalent, but did not differ between fertilizer treatments. However, there was an increase in stand density and yields by increasing rates of nitrogen and phosphorus even though the disease was present in all plots.

- Evaluation of rates of nitrogen and phosphorus and their effects on severity of root rot of Tobin canola.

  Varying fertilizer rates did not effect severity of root rot. Root rot progressed over the growing season and increased in severity regardless.

- Evaluation of seeding depth, seeding date, and fungicidal treated seed on seedling blight, root rot, stand establishment and yields of Tobin canola.

  Canola produced from treated seed established better than with non-treated seed at both seeding dates. Late planted seed, emerged best. Canola produced from treated seed yielded

higher than from untreated seed regardless of seeding date. When comparing yields of Tobin planted at 2 depths and 2 dates, the earlier seeded Tobin planted at one inch depth yielded better than the later or deeper seeding.

- Root rot severity increased from bolting and early flowering stages to the pod and seed set stages of development. Severity of root rot was higher for plants seeded early than from plants seeded later in the season. Treated seed had better stand establishment and higher yields than untreated seed.

WEED CONTROL SECTION

Conditions for weed growth were variable in 1988. The whole province suffered from moisture shortages in the spring, most of the northern two-thirds had adequate moisture from early June through to mid-August. These growing conditions favored perennial weeds such as Canada thistle, perennial sow thistle and toadflax. The poor growing conditions in early June caused many producers to delay spraying annual broadleaf and grassy weeds until it was too late. This resulted in abnormally high weed populations in most areas and significant production of weed seed which will create problems next season.

Observations:

- Concerns arising from the difficulties in the disposal of plastic and metal pesticide containers is creating a change in packaging methods. Since plastic containers are more difficult to dispose of, one manufacturer has decided to change to metal containers. Others are increasing the concentration of the product to reduce the number of containers required. The development of dry flowable formulations has allowed packaging some products in plastic lined paper cartons. Others are using soluble bags which dissolve in the spray tank.

- The pesticide industry continues to consolidate. Elanco and Dow merged, forming Dow-Elanco. Pfizer, Transbas, Yellowstone and Laters merged forming United Agri Products. These mergers will result in reduction of competition.
- The pending patent expiry and possibility of new producers of glyphosate has resulted in a reduction in the price of Roundup and in Monsanto marketing glyphosate under two new trade names - Wrangler and Loredo. Anticipated price of these products may make it uneconomical for competition to enter the market.
- Several native plants have developed into weed problems on cultivated lands. Wild rose, spreading dogbane, and sun spurge are examples. New tillage and cultural practices may be causing it.
- The U.S.A. Conservation Reserve Program has inadvertently introduced potentially serious weeds into Northern Montana. "Wire grass" was present in a batch of reclamation seed shipped into Alberta. Fortunately it was detected before being seeded. Measures to prevent weed introductions and the implementation of eradication measures upon detection will be developed.
- The use of fungicides and plant growth regulators in cereals has not gained the wide range acceptance anticipated several years ago. Use is still limited to a select number of progressive grower organizations.

a. <u>Crop Protection Laboratory - Olds</u>

Screening new varieties for disease resistance aided the Cereal Breeding Program being conducted by the Field Crops Branch. Approximately 500 lines were screened in the greenhouse for surface borne smuts (such as true loose smut), covered smut of barley and common bunt of wheat. Field verification will take place in 1989.

A program was initiated to evaluate using fungicides and plant growth regulators on barley.

b. Weed Survey

The weed survey was extended to Regions 1 and 5 in 1988 and 341 fields were surveyed. The results identified weeds posing a threat to crop yields. Excellent participation was received on the questionnaire with more than 70% returned. The questionnaire documented cropping practices, such as seed source, weed control, fertilizer use and safety precautions. Research, extension and regulatory programs are planned or have been initiated to address problems observed from the survey results. The survey will continue in Regions 2, 3 and 4 in 1989.

c. Crops of Alberta

The theme for this years Crops of Alberta demonstration plot was "Soil Conservation" with emphasis on winter annual crops and seeding directly into stubble. The horticultural portion of the display was increased to be more interesting to the public. The display was viewed by over 400 urban elementary school children. It served as a living laboratory for the cereal and oilseed class from the University of Alberta and was featured on the Agriculture Service Board Tour.

d. Weed Alert Program

The Weed Alert Program produced maps of weed distribution. An addition was to use this program for phenology data. This is the use of native plant species as indicators of environmental conditions.

e. Research and Development

Two cases of weed resistance to sulfonylureas were confirmed by Dupont, one in Stony Plain and the other in Crossfield. Both producers had used Glean continuously for at least the last three years. This selection pressure produced the first chickweed resistant to sulfonylureas. Dupont proposed tank mixes and herbicide rotation as possible solutions. This may be the beginning of a potentially serious situation since Glean has been used for key

weed problems in Alberta over the last several years, ie. stork's-bill, scentless chamomile.

An experiment was conducted on weed control in Field Peas to determine varietal differences in response to broadleaf herbicides. There is immense variability in growth stages between the varieties. Tipu, (a semi-leafless type), was more sensitive to injury from MCPA and Tropotox than other varieties tested.

Twenty-five weed research trials were conducted to determine effective weed control methods. Several were continuations of previous trials. Weeds investigated were: spreading dogbane, stork's-bill, tansy, milkweed and scentless chamomile. Work continued in the use of a biological control product, BIOMAL on roundleaved mallow. Problems with the formulation are resulting in poor performance. Roundleaved mallow is a problem in the drier portions of the province and BIOMAL requires at least some moisture to be effective.

Application equipment projects conducted this year were conversion of roadside sprayers into dual purpose roadside hydroseeders. This effective and inexpensive system satisfied the needs of many municipalities. Cooperation with Alberta Transportation was successful, many suggestions for proper spraying of roadsides were implemented.

f. Knapweed Eradication Program

Progressed very well during 1988. All the sites were inspected and treated. Some early sites had no knapweed for five years and are assumed eradicated, others had a few plants and require more effort. Four new infestations were found in 1988 - two in the County of Wheatland and two in the County of Lethbridge. These infestations were all treated and will be monitored to ensure eradication. British Columbia and Montana continued their support by maintaining knapweed-free buffer zones at the respective borders. Enthusiasm is high as landowners and municipalities are

seeing the success of the program and are determined to keep knapweed out of Alberta. The search and destroy approach will continue in 1989.

g. Nodding Thistle

No new infestations of Nodding thistle were reported in 1988. Several sites have been free of nodding thistle for five years while the rest have been reduced to isolated plants.

h. Leafy Spurge

Leafy Spurge is a problem along the banks and flood plains of the major rivers in Southern Alberta. Proximity to water limits chemical control and the rough terrain makes it difficult to use other measures. To overcome these limitations a project was initiated using 1,300 sheep to graze the leafy spurge. The project was a co-operative undertaking by Alberta Agriculture, M.D. of Cardston, Public Lands Division, local sheep producers and the Blood Band. Sheep were grazed from late May to the end of August. After a three week adjustment period to leafy spurge grazing the sheep selectively grazed leafy spurge over native grasses. Preliminary results indicate sheep graze leafy spurge very effectively and can provide control in environmentally sensitive areas.

i. Minor Use Program

The Minor Use Program for registering pesticides increased substantially. During 1988, 19 applications were submitted; one received registration (Estaprop for toadflax suppression in cereals). Another six were accepted without requiring additional information and financial support was received to generate data on four others. This program is of particular benefit to growers of forage crops as there were traditionally few registrations in this area. Producer groups have been made part of the process. They feel more committed and have developed an appreciation for the complex and detailed information required and the time and effort required to generate it.

j. Integrated Weed Control

Seven projects dealt with scentless chamomile, white cockle and toadflax in established legume crops. A co-operative project with Public Lands investigated mechanical and chemical methods of controlling Canada thistle in hayland.

Work in conjunction with Agriculture Canada continued on the tolerance of legumes and grasses to herbicides. Methods of establishment of alfalfa and brome crops were investigated to determine the effect of weeds. Information will be used in registration and safe use of herbicides.

The use of the flea beetle (Aphtona nigriscutis) for the biological control of leafy spurge is progressing well. The beetle was established in the St. Mary River Valley near Cardston in the early 1980's and has multiplied to 450 insects per square meter. In 1988 the insects were re-distributed to 17 sites from Cypress to Wetaskiwin. Re-distribution will be increased in 1989 with the aim of getting the insect onto every patch of leafy spurge in Alberta. For effective biological control, three to four biocontrol agents are required for each weed species. Work will continue to ensure this is accomplished.

In response to the soil conservation thrust, evaluation of chemical fallow alternatives were undertaken. Information development and technology transfer activities will continue in conjunction with CARTT.

k. Training

The Crop Protection Update used a "HANDS ON" approach and was very well received by the students. A number of issues were addressed including: pesticide registration process, herbicide update, up and coming pest problems such as Russian wheat aphid, blackleg, weed resistance to herbicides. The displays of live material enhanced the presentation and were effective tools in demonstrating symptoms.

To facilitate the proper and effective use of the Weed Control Act, 6 weed inspectors schools (1 per region) were conducted prior to the 1988 field season. Training concentrated on the Act, proper enforcement conduct, and weed identification. It reached 150 new and returning inspectors and facilitated the weed inspections and control activities of municipal government.

Specialized training was provided to municipal field staff involved in the weed survey to ensure that uniform and effective data collection techniques were employed.

PROBLEM WILDLIFE SECTION

The Problem Wildlife Section was responsible for supervision and coordination of three programs: rat control, rabies suppression in skunks, and prevention and control of coyote depredation of livestock and poultry. Responsibility for prevention and control of wildlife depredation of crops and livestock is in co-operation with the producer, with assistance from the Municipal Agricultural Service Boards. The section provided extension services for the prevention and control of crop damage from rodents (primarily pocket gophers and Richardson's ground squirrels), nuisance birds (primarily magpies, blackbirds, sparrow and pigeons) and other mammals that conflict with human interests (bats, rabbits, porcupines, and squirrels).

a. Rat Control Program

Alberta was kept essentially free of Norway rats for the 38th consecutive year. Rat control was conducted in seven rural municipalities along the Alberta-Saskatchewan border in a control zone 30 km wide and 600 km long.

The provincial rat control program was similar to previous years. The only change in manpower was the reduction from one-man year to a half-man year in the Municipal District of Cypress. On April 1, 1988, Alberta Agriculture assumed complete responsibility for rat control in the Municipal District of Acadia Valley by adding this

responsibility to the provincial problem wildlife specialist position in Oyen. In total 5.75 man-years were spent on rat control in addition to coordination and administration.

A long, cold winter contributed to a decrease in rat infestations and a decline of 1,002 inspections compared to 1987. Rat bait used in the control program decreased by 4,764 kg of dry warfarin cereal bait and 357 L of water-soluble warfarin compared to 1987 (Table IX). One reason for the reduction in bait use was our action to restrict free distribution to the control zone thus preventing extensive use of rat bait for control of other rodents.

TABLE IX

NORWAY RAT CONTROL ON THE ALBERTA-SASKATCHEWAN BORDER 1988-89

Municipality	Person Years	---Bait Used---- Dry(kg)	Water Soluble	No. of Premise Inspections	Infestations 1986	1987	1988
Bonnyville M.D.	0.50	293.0	0	1375	1	1	0
Vermilion River	1.75	2363.0	860	2545	29	66	43
Wainwright M.D.	1.0	1255.0	76	1066	0	0	2
Provost M.D.	1.0	2890.0	462	1646	39	26	19
Special Areas	.75	1535.0	176	734	24	33	9
Acadia M.D.	.25	235.0	26	230	0	0	0
Cypress M.D.	.50	709.0	0	375	0	1	0
	5.75	7280.0	1600	7971	93	127	73

A total of 7,971 inspections including farms, grain elevators and other premises in Alberta were conducted by Municipal and provincial pest control inspectors. Each premise was inspected from 1-3 times during the year. An additional 1,544 inspections were carried out in Saskatchewan by Alberta inspectors from the Municipal District of Wainwright and Vermilion River County. A total of 73 infestations were eradicated through the cooperative efforts of residents and government personnel in Alberta.

Within the interior of Alberta, a concerned public continued to report suspected rat sightings. Most reports were found to be muskrats, pocket gophers, tree squirrels or mice. All suspected infestations were investigated by provincial and municipal pest control inspectors.

b. Rabies Vector Control

The aim is to prevent the spread of rabies in Alberta. The method is primarily through skunk removal, direction comes from the Central Rabies Control Committee.

In 1988, a total of 19 skunks, 8 bats, and 1 cow were diagnosed to have rabies. Distribution of rabies was: County of Warner - 9 rabid skunks were removed between Milk River and the United States border; M.D. of Cypress - 6 rabid skunks were removed near Medicine Hat and Seven Persons; County of Forty Mile - 2 rabid skunks were removed near Manyberries; and County of Newell - 2 rabid skunks were removed north of Brooks (Table X).

Skunk depopulation was conducted in a 40 km wide buffer zone along the Alberta/Saskatchewan border from the M.D. of Wainwright to the United States. In total, 455 skunks were removed from this declared "rabies vector control zone". The 6 confirmed skunk rabies cases in the M.D. of Cypress are a significant drop from the previous year's 21 cases, but still a concern as 4 of these skunks were found near Medicine Hat, which is west of the fourth range, and outside of the vector control zone.

TABLE X

RABIES POSITIVE ANIMALS IN ALBERTA

YEAR	SKUNKS			BATS	OTHER	TOTAL
	WARNER/ FORTY MILE	NEWELL	ELSEWHERE			
1980	53	0	1	11	1 cat	66
1981	22	1	0	9	1 dog	33
1982	14	29	0	7	1 horse	52
1983	27	3	2	5	3 cats	40
1984	4	3	0	5	1 dog	13
1985	6	1	1	4	1 human	13
1986	0	1	0	5	0	6
1987	9	2	22	7	2 cats 2 cows	44
1988	11	2	6	8	1 cow	28

During rabies control efforts throughout south and east Alberta a total of 1,059 skunks were removed in 1988. Of the skunks taken, 951 or 90% were taken with strychnine egg baits. Trapping and shooting accounted for 108 skunks. In all, 3,117 poisoned eggs were placed at 820 sites, usually in small culverts or under abandoned farm buildings. Strategic placement of these poisoned baits added to the safety of the program and reduced non-target poisoning from 13 in 1987 to only 8 recorded cases: 3 red fox, 2 ground squirrels, 1 badger, 1 coyote and 1 weasel. Bat rabies continues at a low incident rate with 8 confirmed cases of rabid bats in 1988.

c. Coyote Damage Control Program

The primary objective of the coyote damage control program is to minimize livestock losses by providing training, resources and assistance to affected farmers. The program is structured so farmers can solve predation problems themselves with guidance and help from municipal and department personnel.

The program operates at the municipal level through the agricultural service board. Municipal agricultural fieldmen are the first avenue of help for farmers with predation concerns. Provincial problem wildlife specialists train agricultural fieldmen and provide on-farm support, training and assistance at the request of the fieldmen, or when fieldmen are unavailable to respond to complaints.

Management improvements and changes to discourage predation, such as carrion removal, improved fencing, night confinement of sheep, closer supervision of expectant livestock and young, and confinement of poultry were promoted.

Non-lethal predator control measures are encouraged, especially with sheep producers suffering persistent coyote problems. Electric fences and guard dogs are effective in some instances and used widely throughout North America. An electric fence about 15 km long was built around the Kleskun Lake grazing reserve in early 1987. Over 2,000 sheep graze on this reserve each year. Predator losses prior to electric fence construction were in excess of 100 animals annually. In 1988 no confirmed predator losses occurred at the pasture.

The coyote damage control program also relies on killing problem coyotes with toxicants and other restricted devices. Safety, correct placement and judicious use of devices are emphasized to protect the user, other humans, and non-target animals. The department continued to advocate the selective and limited use of lethal devices and toxicants during resolution of predation problems.

Cyanide guns and strychnine baits are important tools for coyote control (Table XI), however single lethal dose 1080 baits, registered for use in 1984, have become the most commonly used

toxicant. In comparison to strychnine, single lethal dose 1080 biats are more specific to members of the dog family and less hazardous to humans, wildlife and domestic animals.

TABLE XI
TOXICANTS AND DEVICES DISTRIBUTED FOR COYOTE CONTROL

Year	Cyanide Shells	Strychnine Cubes	Single Dose 1080	Snares
1984	1,175	4,184	147	-
1985	873	2,609	346	-
1986	482	2,166	558	141
1987	565	1,567	1,769	93
1988	696	1,285	2,658	114

Eight large 1080 baits were set by the M.D. of Cardston during the winter, 1988-1989.

The number of predator complaints investigated by problem wildlife staff increased from 237 in 1987 to 254 in 1988. Many more predation complaints were referred to agricultural fieldmen, Fish and Wildlife or did not necessitate an investigation. Most investigations involved coyote predation of sheep and young calves (Table XII).

TABLE XII
NUMBER OF PREDATOR COMPLAINTS INVESTIGATED BY PROBLEM WILDLIFE STAFF, 1988

PREDATOR	PREY					
	Sheep	Cattle	Hogs	Poultry	Other	Totals
Coyote	143	51	3	24	7(goat)	228
Dog	9	1	1	0	0	11
Wolf	1	0	0	0	0	1
				(a)	(b)	
Other	1(cougar)	0	0	9	4(raccoon)	14
TOTALS	154	52	4	33	11	254

(a) 6 fox, 2 racoon, 1 skunk
(b) Field corn

The number of cases of predation handled by Agricultural Fieldmen has varied among years but increased in 1988 as did the amount of toxicant issued (Table XIII).

TABLE XIII
TOXICANTS ISSUED FOR COYOTE CONTROL BY AGRICULTURAL FIELDMEN

Year	Cases	Number of Toxicants Issued/Used	Toxicants/Case
1984	520	4,125	7.9
1985	528	2,933	5.6
1986	398	1,945	4.9
1987	513	2,530	4.9
1988	619	3,453	5.5

FIELD CROPS BRANCH

Summary

The Field Crops Branch has two operational sections - Crop Production and Crop Research, with a full time staff consisting of 17 permanent positions and 9 temporary salaried positions.

The branch is involved in province-wide crop extension and research relating to cereals, oilseeds, special crops, forages, and seed technology.

The research section's mandate is to develop improved varieties of feed grains with emphasis on feed barley. Programs are also conducted in spring and winter triticale and winter wheat for central and northern regions of Alberta.

Co-operative research is conducted with the University of Alberta, Agriculture Canada and the Agriculture Environmental Centre, Vegreville to evaluate varieties of oilseeds and cereals adaptable to Alberta.

The production section provided extension programs through department staff, private industry producer groups and directly to producers.

The municipal co-operative seed cleaning plant program for replacing and upgrading 77 plants is co-ordinated through the production section of the Field Crops Branch.

BRANCH ACTIVITIES

Production Section

a. Cereal Crops

The publication "Varieties of Cereal and Oilseed Crops for Alberta" was revised, updated, and distributed through "Farm Light and Power" February issue, and Agdex 100/32 at district offices. The information presented in this publication is based upon our extensive regional variety testing program to aid farmers in selecting the most suitable varieties for their areas.

The major extension demand this year was in barley (particularly malt), hard red spring wheat, oat and semi-dwarf wheat and barley production. Interest remains high in minimizing cash inputs, but to still receive the greatest economic return possible.

Seventy-seven municipal co-operative seed cleaning plants processed 30.4 million bushels of cereal grain and oilseeds for the year ending June 30, 1988. This amount was up 0.5 million bushels from the 1986-87 year, and 2 million bushels above the five-year average.

Table XIV shows the amount of seed processed in 1988.

TABLE XIV

GENERAL SUMMARY (BUSHELS)	1987-1988
Total cleaned for Commercial Seed	23,457,200
Total cleaned for Pedigreed Seed	2,346,414
Total cleaned for Seed	25,803,614
Total cleaned for Dockage Removal	4,133,629
TOTAL PROCESSED	30,385,715
Average grain processed per plant - 1988	394,620
Five-year average grain processed per plant	374,000

There were 34 seed plant upgrading grant applications totalling $364,021 of grant money. This compares to 57 applications totalling $512,743 of grant money last year. It should be noted that our provincial grant cost share was reduced from 40% or 30% over these two years, allowing $364,000 to cover about the same total amount of upgrading. This continues to be a very popular, worthwhile program.

One new seed plant was constructed at Pincher Creek and one new replacement plant at Willingdon. The Willingdon plant cost about $1.1 million and a new mini-plant design was built at Pincher Creek for $500,000. These plants were cost shared for a total budget expenditure of $650,000. Future plants planning on replacement are; Rycroft in 1989-90, Boyle 1990-91, Three Hills 1990-91, and Queenstown in 1992-93. Our provincial replacement program provides technical and financial assistance to these plants, each of which will cost about 1.2 to 1.3 million dollars.

b. Oilseed Crops

Principle activities were directed towards technology transfer through production meetings, field tours, on-farm demonstrations, media releases, agronomic training seminars for industry field representatives and individual contacts. Numerous articles and materials were prepared and assembled for regional and district staff, educational institutes and commodity groups. Growers and industry were very supportive of these activities.

Close liaison was maintained with oilseed organizations, crusher and exporters to facilitate communications within the oilseed complex and provide resource information. Two Alberta canola industry meetings were held to discuss the common concerns of the canola industry with researchers, crushers, producers, seed growers, grain handlers and government. Input, direction and assistance were provided to various crop production clubs throughout the province. Growers in these clubs have modified and

adopted proven research technology and achieved higher yields with lower cost per unit of production compared to their normal production practices.

Close liaison was maintained with Agriculture Canada regarding the Canada/Alberta canola breeding project at Beaverlodge, Lethbridge and Saskatoon, as well as other Farming For the Future, federal and university oilseed research projects. Direction and assistance was provided to Paladin Hybrids of Brampton, Biotechnica Canada in Calgary, Conti Seeds of Winnipeg, and Allelix of Mississauga, in their respective canola breeding research programs. The breeding programs, both private and public, have rapidly advanced with the registration of 11 new varieties in the past two years. Several of these varieties will be advantageous to Alberta growers through improved disease tolerance and superior yields. Agriculture Canada research on canola seedling vigor has indicated significant differences in stand establishment and yields between various certified seed lots. This continuing research could have a positive impact on identifying, for seed growers, those production factors which improve certified seed viability and vigor.

Participation in the Flax Council Research and Technical Committee, the Canola Council of Canada Crop Production Committee and the Western Canada Canola/Rapeseed Recommending Committee provided direction to flax and canola research projects relevant to Alberta growers' needs and concerns. The Canola Council's Grow With Canola program continues to provide Alberta canola growers with timely and useful production technology via on-farm demonstrations, grower field tours and production seminars. The Grow With Canola program has clearly shown that, even under stress conditions caused by drought, the adoption of proven production technology by co-operating growers resulted in yield increases over their normal production practices. Input and direction was provided to the Grow With Canola program including agronomic research projects on sclerotinia stem rot, blackleg disease, seedling vigor, soil fertility, weed control tillage, and seeding practices.

Reviewed and presented an Alberta Agriculture brief to Agriculture Canada regarding their Brassica breeding research program in Canada. Arranged and participated in an Alberta Agriculture mission to the U.S. Pacific Northwest to evaluate spring and winter canola production and potential.

c.. Perennial Forage Crops

Local forage associations and the Alberta Forage Council continued to be very active. Ten forage associations were supported with provincial operating grants totalling $310,195. New guidelines for funding associations came into effect for this operating year. They assured forage associations of funding while maintaining fiscal restraint. Maximum grants per association are now set at $30,000.00 per year. Associations which have been receiving amounts in excess of $30,000.00 will have the excess reduced by equal increments over a ten year period.

Hay acreage increased by 7% over last year to 4.6 million acres. Hay yields were good in agricultural reporting areas 5, 6 and 7, i.e. west central, north central and Peace River areas. Yields were also good in irrigated areas. As these areas represent over 80% of Alberta's hay production potential, the over-all provincial hay supply was more than adequate for domestic needs. Regions with hay shortages included much of agricultural reporting areas 1, 2, 3 and 4 especialy eastern Alberta. The combined acreage and yield give an increase of about 10% for total hay production this year to continue a trend towards greater hay production.

Processed forage production increased compared to the previous year. Pellet production totalled 298 thousand tonnes (up from 184 thousand tonnes in 1987) largely due to a major increase in sun cured product from northern Alberta. Alfalfa cube production was also up at about 125 thousand tonnes. Densified hay production, although still a fledgling industry was approximately double that of the previous year at about 6 thousand tonnes. Most densified

hay production was alfalfa and/or timothy. Densifying equipment and hay purity were the main limitations to production. Export of conventional bales to the USA increased sharply due to a severe drought in the US mid west.

Tame pasture yields generally followed the pattern for hay with sufficient production where rainfall was adequate. The early dry spring resulted in pasture shortages at the beginning of the grazing season. Tame pasture conditions in drought areas were generally worse than for hay due to continued grazing pressure.

d. Annual Forages

Annual forages were used extensively in 1988 as producers attempted to supplement their perennial crops to offset the effects of the drought. In areas where it did rain, much of the spring cereals were left for seed.

The use of winter cereals as a pasture crop is widely recognized as a tool to add flexibility and extra production to the producers management plan. Intercropping a winter cereal with a spring cereal taken for silage, has provided producers with a productive quality pasture in September and October that they did not have using perennials. Winter triticale has shown to be very adaptable in this situation and utilizes the preferred qualities of the winter wheat and fall rye.

The interest in field peas as a silage crop has increased as producers (in most cases dairy producers) attempt to harvest a higher quality forage. As the agronomics of growing field peas improves, producers are finding that yields are better than those predicted by earlier research. Field Crops Branch has been promoting the proper agronomics and harvesting of the crop to maximize yields. There still needs to be research in this area to determine the most productive types: indeterminate vs. determinate, quality of semi-leafless vs. leafed varieties, time of harvests, companion crops, etc.

Cereals for a greenfeed or silage crop still make up the majority of acres in annual forages. Oats and barley are the crops of choice, although the soft wheats are gaining popularity as a silage crop for feedlots in the irrigation districts. Varieties recommended are generally based on producer testimonials and/or variety grain yields, extrapolated into silage yields.

There has been little interest in minor crops such as the kales, sunflowers, vetches, non-dormant alfalfas, and rye grasses.

e. Range Management

The section's activities were directed to extension through field tours, publications and associations. This involved the Chinook Applied Research Association (C.A.R.A.) at Hanna, Field Services at Lacombe and Claresholm, and Antelope Creek at Brooks.

Trained range specialists were hired, for the first time, by the Eastern Irrigation District (E.I.D.) and the special areas. The E.I.D. manage 600,000 acres of rangelands from Brooks. The special areas administer 5,000,000 acres of rangeland out of Hanna.

Drought severely affected rangelands in Alberta during the 1988 season. Breeding stock on rangeland were drastically reduced in southern Alberta. Many cattle were summered in the Peace River country on deeded land and grazing reserves. Stocking rates on C.A.R.A. administered grazing trials were reduced near Hanna.

Range improvement with fire to check aspen invasion in the Neutral Hills is continuing for a second year. University staff are evaluating to check the effectiveness of this tool in conjunction with short duration grazing.

The "Guide to Range Condition and Stocking Rates for Alberta Grassland" was updated and published by Public Lands in 1988.

Field days at the Antelope Creek Habitat development, demonstrating rotational grazing with wetland management to produce waterfowl, is showing beneficial signs.

The conservative stocking rates at the Canadian forces base are still producing grazable rangeland in spite of the drought in the 1988 season.

f. Special Crops

Alberta special crop acreage continued to increase in 1988. The acreage was estimated at 410,000 for all species last year, an increase of 10,000 acres over 1987. It is worthy to note that the acreage has increased four fold since 1978.

During the past 10 years, farmers' interest has been focused more and more towards pulse crop production. More than half of the 410,000 acres in 1988 were sown to dry beans, soybeans, lentils, fababeans, and field peas. World markets for these grains have remained strong. As a result approximately 70 million dollars were returned to pulse growers in 1988.

The Pulse Grower's Association of Alberta continues as an active and aggressive organization, representing growers in provincial as well as federal negotiations and lobbying. The growers association has, in concert with the Alberta Marketing Council, initiated action and proceeded toward Commission status during 1988. To date, it appears that the August 1989 deadline will be met.

g. Seed Technology

Outside the extreme drought and excessive moisture areas, the remainder of the province experienced fairly satisfactory production. The open fall allowed for producers to get their harvest off with a fairly good quality. Seed stocks for most species were in good supply. Seed production acreage remained strong. Forages and peas showed a substantial increase in acreage. Private varieties are beginning to make their mark in the industry.

Once again the seed technology workshop was well attended. About 65 participants were in this years program. It appears that Olds College will be going ahead with the Seed and Grain Technology program in 1989. Fairview College also has a proposal in place for this type of program. The colleges will be working together on these programs.

The Canadian Forage Seed project experienced another demanding year. Interest in forage seed was still strong in 1988-89 despite the decline in prices and markets. Inventories for most varieties within the project remained low. Requests for 16,110 kg. of foundation seed were handled by the branch. Supplies were not adequate to meet demands for some species. The Canadian Seed Trade Association has assumed the administration of the varieties within the project. Applications and allocations are still the responsibility of the provincial government.

The Alberta branch of the Canadian Seed Growers' Association had a very successful year. Membership remained strong at 1,068, and inspected acres were up slightly to 230,232. Grande Prairie was the host site for the 1989 - 60th annual convention for the association.

SeCan membership currently consists of 2,630 members, 645 of these members are from Alberta. SeCan varieties currently account for 65% of the inspected acreage, and they handle 211 varieties of which 75 are being actively promoted. They have placed a marketing representative in Alberta on a full time basis. Royalty monies paid back to the Breeding Institutes amounted to $1,726,000.00 from 1979-1988. Alberta Agriculture has received $77,000.00 in royalties for their varieties. Membership sales for 1988 were $63,000,000.

The revised Seeds Act, implemented in 1987 appears to be blending with the industry. Inspection fees for 1989 will be $.45 and we will see an additional $.05 increase in 1990. Seed quality

standards have been revised and are currently available as guidelines, they have been discontinued as a source of grading.

Producers continue to support the 4 major provincial seed shows; Lethbridge's Ag Expo, Calgary's Seed Fair and Hay Show, Grande Prairie's Peace Classic and Edmonton's Northland Pedigreed Seed Show. They all had successful functions in 1988-89. Alberta producers faired very well at the Toronto Royal and Regina's Agribition shows. Congratulations are in order to everyone who continues to make these shows successful.

RESEARCH SECTION

Dry spring conditions in 1988 resulted in variable germination at most test sites. Rainfall beginning in mid-June compensated to a large extent for the poor germination at most locations, resulting in near normal yields.

a. Spring Barley Program

The program has continued to follow it's original mandate, the production of high yielding feed type 2 and 6-rowed cultivars of both the hulled and hulless type. Special emphasis is being placed on transferring the semi-dwarf characteristic into the 2-rowed barley germplasm base. During 1988 four 2-rowed and five 6-rowed lines were evaluated in the cooperative registration trials.

In 1988 the 2-rowed barley line TR 607 was registered as "Condor". Tests carried out on feeding hogs at the University of Alberta by Dr. Frank Aherne during 1987-88 indicated that Condor can replace wheat in a barley/wheat ration and also replace up to 11% of the normal soybean supplement. This can be a sizable saving in feed costs for the hog industry and is especially of importance to the young pigs. Yield stability (95-98% of a hulled cultivar) and quality indicates that Condor will provide a suitable replacement for currently availabe 2 and 6-rowed hulless cultivars. Hulless barleys such as Condor may have additional value in the human food

markets. However, seeding rates, harvesting methodology, and resistance to weathering are areas in which further study is required at both the research and production level.

The number of registered varieties developed from the program is now 5 barleys and 1 spring triticale. Royalties and seed sales of these varieties has presently reached $105,600.01. Another $135,347.76 was received from the sale of by-products for a total revenue to date of $240,947.77.

b. Spring Triticale Program

A major emphasis was placed on incorporating sprouting resistance into lines with improved test weight and maturity. All of the currently active breeding material in the program contains sprouting resistance either from other triticale or conventional wheat backgrounds. Heavy selection pressure was also placed on the awnless characteristics as a means to improve the potential for production of greenfeed as well as silage. Fine tuning of the program resulted in a reduction in the numbers of lines and populations retained. In 1988 2 plump seeded lines with maturity at least 4 days earlier than Wapiti were evaluated in the Western Spring Triticale Cooperative Test.

c. Winter Triticale Program

Along with the reduction in the physical size of the spring triticale program was a increased emphasis on the winter cereal component of the breeding programs. Starting in the 1988 season the incorporation of resistance to diseases such as bunt of wheat was initiated. A large percentage of the advanced winter wheat lines are a result of crosses of the winter wheat cultivar Norstar and semi-dwarf germplasm lines. The program emphasis has been placed on forage potential as well as winter hardiness. At least one of the advanced (81DE01015) winter triticale lines will be put forward for registration in 1990. Quality evaluations of 81DE01015 at the University of Manitoba indicate that the sprouting

resistance of 81DE01015 is significantly improved compared to Wintri, but our own dormancy tests have not confirmed this factor to date. Growth facilities and quality testing will be a major limitation to the rapid development and evaluation of superior high quality semi-dwarf winter wheat cultivars in the very near future.

d. Other Programs

The agronomist position was vacant for most of 1988. However many of the agronomy related programs were carried in a truncated format. A detailed evaluation of the MEY program was continued as was the emphasis on evaluation of production potential in the special crops. Pat Jedel joined the research staff as agronomist in October. An expansion of the agronomy program into evaluation of drought rsistance is expected in 1989.

In 1988 eighteen long term cereal based rotations were began at Lacombe, in 1989 another 14 rotations will be added. This work is aimed at gathering long term crop and soil data under these different cropping patterns. It is also our desire to keep cost return records for the management of these different cropping systems.

Work is continuing in the areas of intensive crop management with projects in cooperation with Doug Penney of the Soils Branch and Dr. L. Peining of Agriculture Canada. More detailed information on these trials are available in the annual report of the Research Section.

Preliminary work was started on the growth facility in the spring of 1988. By year end the design phase was completed and the project was ready to go out for tender. This growth facility will allow major emphasis to be placed in the area of disease resistance, winter cereal variety development and drought tolerance.

A more detailed annual report on the Cereal and Oilseed Variety Testing program and the Cereal Research program is available from the Agriculture Library in the J.G. O'Donoghue Building in Edmonton and the Field Crops Branch Library in Lacombe. Annual Reports for the Breeding and Agronomy projects are also available at these libraries.

SOILS BRANCH

Summary

Technology transfer, applied research and diagnostic activities were provided to department staff, agri-business, research agencies and directly to farmers. As farmers continue to cope with narrower cost-return margins, more efficient crop production on normal and problem soils and use of inputs e.g., fertilizer continued to be in demand.

Increased field research was conducted to deal with crop production problems. Copper deficiency of wheat and barley was studied to determine extent and severity of the problem. The Agriculture Lime Freight Assistance (ALFA) program was revised to encourage development of more local supplies of liming materials by providing an incentive payment on the product as well as on freight.

BRANCH ACTIVITIES

1. ADMINISTRATION SECTION

a. Agricultural Lime Freight Assistance (ALFA) Program

This program of financial assistance, available since 1981, was revised effective April 1, 1988 to encourage the development and use of local suppliers of marl. Marl is a fresh water deposition of calcium carbonate. In addition to 50% of the cost of freight for marl, an incentive of $3.00 per cubic metre of product is now paid. No new developments came into production during the fiscal year as a result of program change however there was some development interest shown for a supply near Clyde. The financial assistance of 80% of the transportation cost above $5.50 per tonne was continued on agricultural lime. The maximum grant per applicant in any one fiscal year was reduced from $15,000 to $8,000.

Grants under the program totalled $128,058 for the transport of 5,216 tonnes of lime and marl. Following a 3 year decreasing trend of grant payments under the program, there was an increase of 16% this year. The present use of the program still reflects the limited cash flow situation of farmers.

Summary of the program since inception in 1981 is shown in Table XV.

b. Alberta Farm Fertilizer Price Protection Plan

The plan, introduced in 1985, continued to provide grants to farmers using fertilizer for crop production on land farmed in Alberta. Grant payments continued at $50 per tonne of nitrogen and $25 per tonne of phosphate. A summary of the program is provided in Table XVI.

TABLE XV

AGRICULTURAL LIME FREIGHT ASSISTANCE PROGRAM - SUMMARY

	1981/82	1982/83	1983/84	1984/85	1985/86	1986/87	1987/88	1988/89
No. of applicants	62	96	149	81	87	69	39	31
Total grant ($)	150,994	349,363	645,359	302,743	335,039	315,164	110,017	128,058
Number of tonnes	4,514	11,289	21,487	11,493	12,275	11,606	4,624	5,216
Average grant per tonne ($)	33	31	30	26	27	27	24	25
Average grant per applicant ($)	2,435	3,797	4,331	3,738	3,851	4,568	2,821	4,131

TABLE XVI

ALBERTA FARM FERTILIZER PRICE PROTECTION PLAN - SUMMARY

Year	Grant Assistance $	Fertilizer Purchases tonnes	Number of Applicants	Average Payment $
1985-86	$ 21,231,853	942,865	31,161	677
1986-87	17,601,088	788,495	28,385	620
1987-88	17,415,172	791,415	27,473	634
1988-89	18,115,617	871,744	29,998	621
Total/average	75,115,612	3,394,519	117,217	641

Caution should be exercised when comparing the fertilizer purchase figures under this plan with the fertilizer sales statistics in Alberta found elsewhere in this report. The fertilizer purchases shown are based on farmer receipts received during the fiscal year (April 1 to March 31). Fertilizer sales figures are for the period July 1 to June 30. Until this year, purchases made under the plan in previous years were eligible for payment in the year they were received by program administration. In addition, the plan allowed for purchases made after August 1, 1984 prior to the announcement on April 1, 1985.

The administration of the program has been carried out by the Soils Branch since 1985. On October 1, 1988, program administration was transferred to Central Program Support.

c. Other Activities

Ross McKenzie took educational leave to complete his studies toward his doctoral degree at the University of Saskatchewan. He was to receive his degree in May, 1989. The topic of his thesis was "Mechanisms Controlling Soil Phosphorus Dynamics in Chernozemic and Luvisolic Soils."

Doug Penney and Adolph Goettel represented the branch on the Canada-Alberta Research and Technology Transfer (CARTT) Agreement. The agreement involves two components; research (Component A) and Technology Transfer (Component B). The agreement continues until March 31, 1993. Considerable liaison was required among two levels of government and the various disciplines and interest groups to develop effective research and technology transfer projects.

2. SOIL FERTILITY SECTION

a. Soil Productivity and Fertility Use

The main activities were in extension and applied research. Extension activities involved meetings with farmers, in-service training seminars for staff and fertilizer dealers, and preparation

of extension publications and resource material. Demand for in-service training of fertilizer dealers increased. Fertilizer dealers have a major influence on a farmer's decision regarding fertilizer use. Therefore they are an important avenue for delivering extension information. The extension information focused on effective use of fertilizer, soil testing and the relationship between production practices and soil degradation.

Field research was conducted at 30 locations on dryland and irrigated crops. Experiments were conducted to measure crop response to major and micronutrients, fungicide and growth regulators on farm fields with typical management histories. The objectives of the research were to calibrate and evaluate soil tests for predicting fertilizer requirements and to determine the need for the cost effectiveness of the various crop production inputs. Crop production systems that result in maximum economic yield and efficient use of inputs are being developed. Supplemental funding for this research was obtained from Farming For The Future and Canada Grains Council.

b. Fertilizer Sales and Price Trends

Fertilizer sales in Alberta peaked at 968,442 tonnes in 1984-85 and then declined to 835,856 tonnes in 1986-87 (see Table XVII). In 1987-88, sales increased to 886,834 tonnes in response to improved crop prices. Trends in nutrient use (N and P) and nitrogen sources are illustrated in Figures II and III.

Fertilizer prices declined in 1985-86 and 1986-87 in response to declining sales. In 1987-88 retail price trends were mixed. The price of phosphate increased 3%, urea increased marginally and anhydrous ammonia decreased 11%.

TABLE XVII

FERTILIZER SALES IN ALBERTA

(By Analysis and Nutrient Content) (Metric Tonnes)

July 1 - June 30

FERTILIZER	1984-85[3]	1985-86[3]	1986-87[3]	1987-88[3]
82-0-0 (Anhy. Amm.)	187,382	157,998	131,260	152,684
46-0-0 (Urea)	245,123	222,947	222,206	237,587
34-0-0 (Amm. NO_3)	85,816	71,210	66,442	73,371
21-0-0 (Amm. SO_4)	27,215	21,885	22,883	42,661
28-0-0 (N. Soln.)	11,374	20,651	46,279	42,137
Other N	--	26,398	20,823	9,884
Urea Phosphates	20,687	--	--	--
MAP	316,874	273,370	244,822	249,260
18-46-0	168	74	67	--
16-20-0	21,338	27,114	21,292	16,386
Other	--	13,405	22,390	21,334
10-34-0 (Soln.)	1,551	1,735	--	--
0-0-60 (KCl)	44,951	34,572	35,140	39,259
Others	11,340	2,235	2,251	2,271
Mixed (N/P/K)	--	--	--	--
Elemental S	--	1,027	--	--
TOTAL	968,442	874,621	835,856	886,834
Nitrogen (N)	352,907	308,908	289,186	315,756
Phosphorus (P_2O_5)	170,943	154,000	140,197	137,369
Potassium (K_2O)	27,420	21,357	21,729	24,328
Sulphur (S)	--	--	14,181	19,101
Ag. Lime[2]	10,242	11,853	11,606	4,624

[1]Source: Western Canada Fertilizer Association, Calgary

[2]Source: Alberta Agriculture, Edmonton

[3]Source: Canadian Fertilizer Institute, Ottawa

FIGURE II

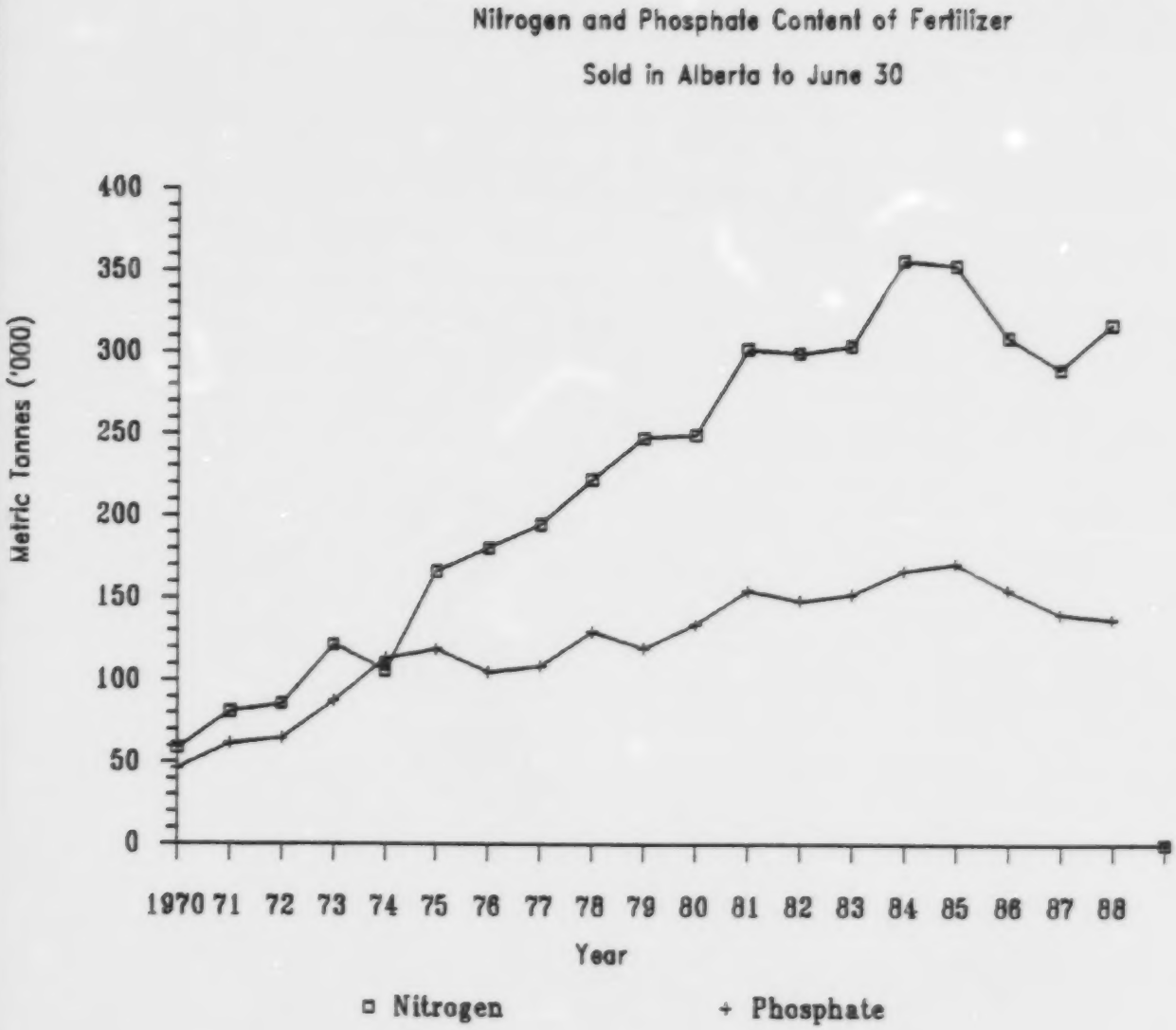
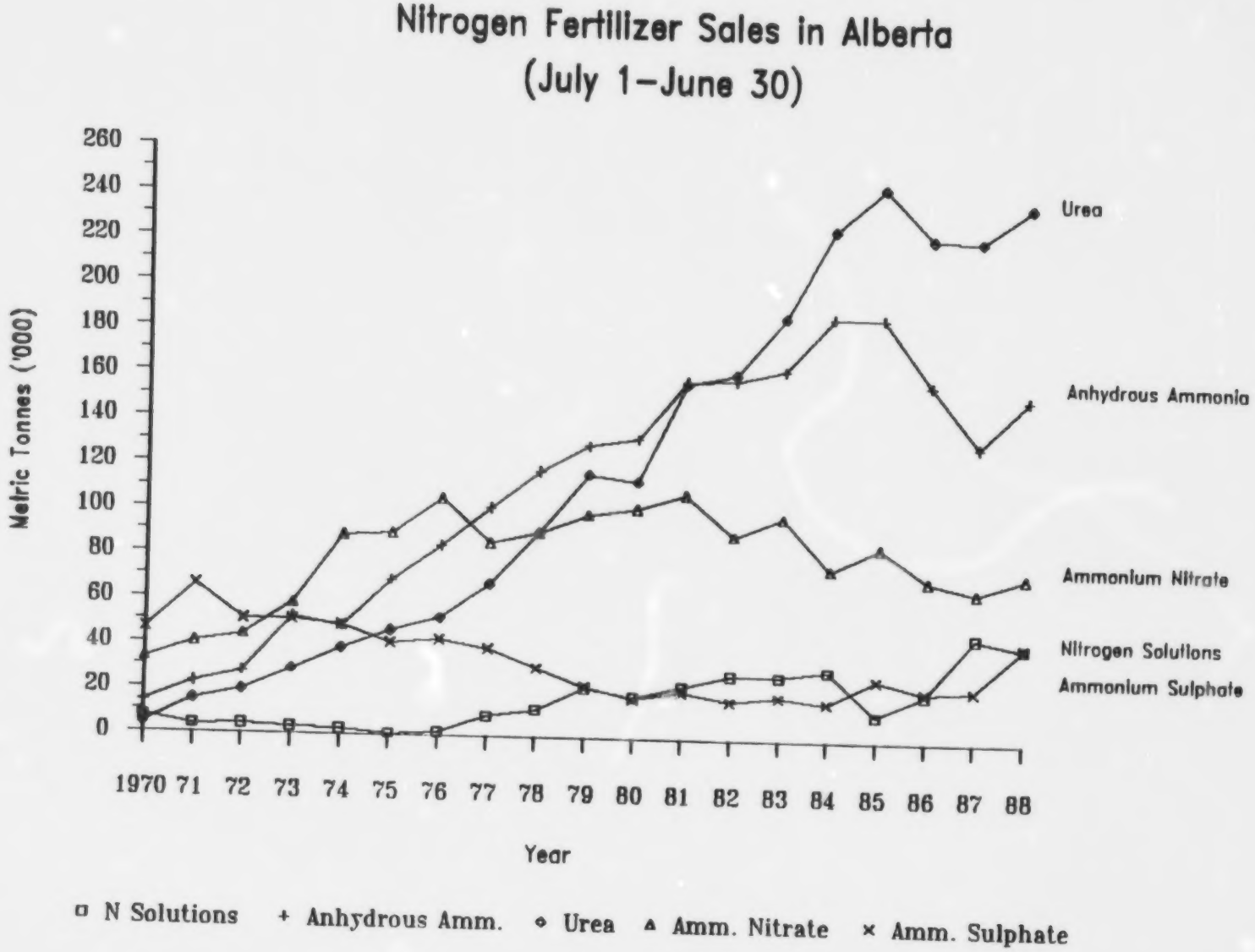

Nitrogen and Phosphate Content of Fertilizer
Sold in Alberta to June 30
Metric Tonnes ('000)
400
350
300
250
200
150
100
50
0
1970 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88
Year
Nitrogen
Phosphate

FIGURE III


Nitrogen Fertilizer Sales in Alberta
(July 1–June 30)
Metric Tonnes ('000)
260
240
220
200
180
160
140
120
100
80
60
40
20
0
1970 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88
Year
Urea
Anhydrous Ammonia
Ammonium Nitrate
Nitrogen Solutions
Ammonium Sulphate
N Solutions
Anhydrous Amm.
Urea
Amm. Nitrate
Amm. Sulphate

c. Field Research Projects

1. Southern and South Central Alberta

A dryland fertilizer research project was expanded in 1988. The project, funded by Soils Branch and Farming for the Future, is titled "Dryland Farming Systems Research for Southern and South Central Alberta". R.H. McKenzie is project manager with H.H. Jansen as co-applicant. The major objective is to calibrate soil tests for N and P using current crop varieties and management practices. Twelve sites were established in 1988 at: Lethbridge, Foremost, Pincher Creek, Claresholm, Vulcan, Brooks, High River, Airdrie, Olds, Three Hills, Drumheller and Strathmore. In the fall of 1988 16 sites were established for 1989. Hard red spring wheat, barley, canola, and a selected fourth crop were seeded at each site. Sites in the brown and dark brown soil zone south of the Bow River were on both fallow and stubble conditions. All other sites were on stubble only.

Two long-term intensive crop management (I.C.M.) experimental sites were established, one at Lethbridge and the other at Vauxhall. Crops at each site included: Katepewa hard red spring wheat, Fielder soft white spring wheat, Harrington 2-row barley, Samson 6-row barley, Global canola and Pivot canola. Each crop has 13 treatments replicated four times. Treatments include fertilizer rates and types, seeding rates, and applications of plant growth regulators and/or fungicides. Crops are being rotated over the 4 years to determine cumulative effects. This was the second year of the project. This research is funded partly by Farming for the Future with D.C. Penney as project manager.

A Western Grains Research Foundation funded project studied phosphorus cycling in chernozemic and luvisolic soils under different crop rotations. This information is being used to

develop a better understanding of soil P cycling and develop an improved ability to make P fertilizer recommendations. Four papers were presented on this research at the Canadian Society of Soil Science meetings, Calgary; American Society of Agronomy meetings, California; Saskatchewan Soils and Crops Workshop, Saskatoon; and Alberta Soil Science Workshop, Edmonton.

2. Central and Northern Alberta

Field experiments with 2 varieties each of barley, wheat and canola were carried out as part of an ongoing Farming For The Future (FFF) funded intensive crop management (ICM) project. Similar experiments were conducted at Lacombe (Field Crops Branch) and Lethbridge (Soils Branch). Fungicide and plant growth regulator (PGR) treatments were evaluated on each crop variety at 2 levels of fertility and 2 plant populations. The 1988 results were summarized for the FFF annual reports. Three years of results were summarized for use in a poster paper presented at a barley production symposium in Saskatoon. The results continued to show that response to the various inputs is site and year specific which indicates that rather than developing general recommendations for these inputs, reliable methods are needed for predicting when they are needed.

Field experiments to determine maximum economic yield (MEY) and calibrate soil tests were carried out with Harrington barley at 3 locations for the second year. Nutrient requirements for MEY were determined with and without other inputs such as chloride, fungicide and PGR. New methods of injecting fertilizers into established crops were also evaluated as a means of increasing fertilizer use efficiencies and reducing risk. These experiments will be continued to calibrate soil tests for various soil climatic conditions and management practices.

A project to determine the extent of copper deficiency on mineral soils, started in 1987 was continued and expanded. Field experiments with wheat and barley were conducted at 4 locations. Crop response (yield and quality) to rates and sources of copper and other micronutrients was measured. The effect of copper fertilization (average 3 sites) on yield and kernel plumpness of Park wheat and Klages barley are illustrated in Figure IV. Soil and plant samples were also taken from affected and unaffected areas in 20 farm fields.

There has been no previous research in Alberta to determine the extent of copper deficiency nor to develop analytical criteria for diagnosing deficiencies. The following observations are, therefore, preliminary.

- Copper deficiency tends to be very patchy within fields but occurs fairly extensively in central Alberta. Its extent and severity is difficult to estimate because of a lack of good diagnostic criteria and the variability of yield loss due to differences in the susceptibility of crops and varieties, and interactions with climatic conditions and diseases. The losses in yield and quality is large in affected areas.

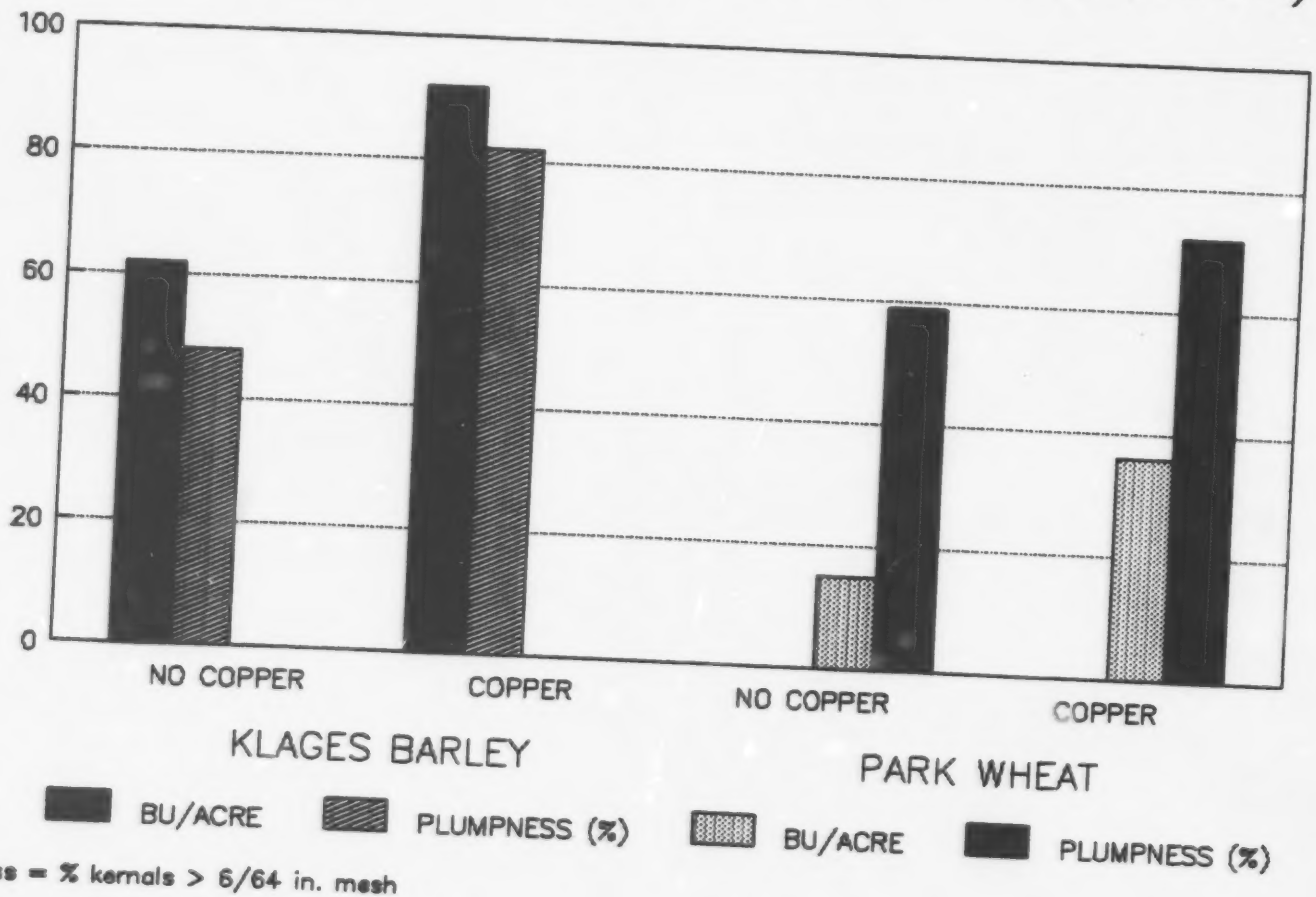
- The current soil test for copper (Cu) is a useful guide but other factors influence the need for copper fertilization.

- Tissue analyses as currently used are of limited value for diagnosing Cu deficiency.

- The application of copper fertilizers to correct deficiencies can result in good economic returns but good diagnostic criteria are required to predict when copper fertilization would be beneficial.

FIGURE IV

Effect of Copper Fertilizer on Yield and Kernal Plumpness (ave. 3 sites, 1988)



Plumpness = % kernals > 6/64 in. mesh

3. SOIL IMPROVEMENT SECTION

a. Main Activities

Main activities of staff involved extension and research relating to the improvement of solonetzic, luvisolic, organic and acid soils. Extension functions included participation in farm meetings, preparation of reports and publications and in-service training for district agriculturists, agricultural fieldmen and fertilizer dealers. A diagnostic service to determine soil suitability for deep tillage was also provided to farmers. Research and extension needs were identified in consultation with local government, department and industry staff.

b. Solonetzic Soils

Crop response to deep plowing and ripping and the application of lime and phosphogypsum were determined in 35 field trials. Drought, particularly in the brown and dark brown soil zones, reduced the number of trials where yield measurements were obtained. The response of wheat to deep plowing averaged 11.6 and 11.8 bushels per acre in the brown and dark brown soil zones. The response of wheat to ripping averaged -0.4, 6.6, 2.8, 7.8 and 5.8 bushels per acre in the brown, dark brown, thin black, black and dark gray soil zones respectively (Table XVIII).

TABLE XVIII

WHEAT RESPONSE (BU/AC) TO DEEP PLOWING AND RIPPING BY SOIL ZONE

Soil Zone	Deep Plowed	Ripped
Brown	11.6 (3)*	-0.4 (2)*
Dark Brown	11.8 (3)	6.6 (5)
Thin Black	—	2.8 (1)
Black	—	7.8 (5)
Dark Gray	—	5.8 (1)

* ( ) number of sites

Nine field trials were monitored in central Alberta to evaluate the potential use of phosphogypsum to increase crop yields on solonetzic soils. Phosphogypsum is a by-product from the production of phosphate fertilizers and is currently being stockpiled at fertilizer manufacturing plants. Crop response data (Table XIX) indicates ripping in combination with 8.7 tonnes per acre of phosphogypsum significantly increased crop yields; higher rates of phosphogypsum did not appear to result in any further increase in yield. Further monitoring of crop yields is necessary to determine the longevity of these treatments.

TABLE XIX

THE EFFECT OF RIPPING AND PHOSPHOGYPSUM ON YIELD (BU/AC) OF WHEAT, OATS AND BARLEY

	Check	Phosphogypsum @ 8.7 tonnes/ac	Phosphogypsum @ 8.7 tonnes/ac ripped	Phosphogypsum @ 17.4 tonnes/ac ripped
Wheat - 1	29.4	35.8	38.1	40.6
Oats - 1	64.1	100.2	105.0	101.0
Barley - 2	32.2	32.3	51.9	59.3

1 - represents 4 site-years
2 - represents 1 site-year

c. Acid Soils

Field trials at 8 locations were monitored to determine crop response to rates and forms of lime. Preliminary results indicate liming beyond pH 6.5 did not provide any further increase in yield. Field trials have shown liming materials are equal when the rates of application are adjusted for their effective neutralizing value. In addition 2 trials were established to evaluate the effect of lime on topsoil tilth and to compare powdered and pelleted lime.

d. Luvisolic Soils

Six trials were monitored in 1988 to evaluate crop response to ripping luvisolic soils; data available to date is presented in Table XX. A substantial increase in yield of barley was obtained from ripping however ripping did not not increase the yield of perennial forage. Insufficient data is available to assess the response of wheat, oats and canola to deep ripping. Further monitoring of trials is required to assess the economics and longevity of ripping these soils.

TABLE XX

CROP RESPONSE TO DEEP RIPPING OF LUVISOLIC SOILS

Wheat	3.6 (2)
Oats	19.8 (2)
Barley	4.8 (10)
Canola	- 1.3 (1)
Perennial Forage	0.0 (9)

( ) number of sites

e. Organic Soils

Research on organic soils included the use of soil test procedures and their interpretation, fertility requirements and an assessment of deep plowing.

Four trials measuring crop response to phosphate, potash, copper and manganese were monitored in 1988. A yield increase of 9 bushels per acre was obtained when 75 pounds per acre of phosphate was applied however, no significant differences were obtained when potash was applied at rates of up to 90 pounds per acre. A combination of copper and manganese applied at 10 and 1.5 pounds per acre respectively increased yield of barley by 24 bushel per acre. A liming trial on a very strongly acid organic soil resulted

in a yield increase of 1.4 tonnes per acre of mixed forage over the check yield of zero. This trial has shown liming may be essential for the establishment of forage stands on undecomposed organic soil. Crop response will continue to be monitored to confirm preliminary trends and to provide reliable nutrient recommendations for producers.

Three trials were monitored to determine the effect of deep plowing on soil temperature and crop yield. Deep plowed soils thawed faster in the spring however yields were not significantly increased (Table XXI). Deep plowing resulted in a firm seedbed which resulted in faster germination and crop establishment and reduced the soil susceptibility to wind erosion. One trial was established to compare layering of peat and mineral soil with mixing and to determine the optimum proportion of mineral and organic materials.

TABLE XXI

CROP RESPONSE TO DEEP PLOWING ORGANIC SOIL

	Yield (Bu/Ac)	
	Barley[1]	Canola[2]
Check	86	24
Deep Plowed	87	25

1 - 3 site-years
2 - 1 site-year

4. SOILS AND ANIMAL NUTRITION LABORATORY

a. Laboratory Services Program

The objectives were to provide:

- Analyses and recommendation services to Alberta farmers,

greenhouse operators and other producers for the economic maximization of crop and animal production.

- Diagnostic services to Alberta Agriculture staff to enable efficient extension and advisory functions to farmers, greenhouse operators and other producers with special soil, crop and animal production problems.

- Research analyses services to public and private agency researchers for projects directed toward the improvement of crop and animal production.

Tables XXII and XXIII show that during the fiscal year 1988/89 the Alberta Soils and Animal Nutrition Laboratory processed a total of 18,197 soils and 12,064 plant and feed materials samples.

TABLE XXII

FARMER, RESEARCH AND OTHER (DIAGNOSTIC, GARDEN, GREENHOUSE) SOIL SAMPLES RECEIVED AND AS PERCENTAGES OF TOTAL SOIL SAMPLES FOR SPECIFIED PERIODS

Period	Soils			
	Farmer (%)	Research (%)	Other (%)	Totals
1985-86	5,576(27.5)	9,737(47.9)	5,004(24.6)	20,317
1986-87	3,657(18.9)	9,898(51.1)	5,798(30.0)	19,353
1987-88	3,337(21.8)	7,927(51.7)	4,061(26.5)	15,325
1988-89	2,616(14.4)	11,576(63.6)	4,005(22.0)	18,197

Of the 18,197 soil samples 2,616 or 14.4% were farmer related, 11,576 or 63.6% were from research projects and 4,005 or 22.0% were submitted for diagnostic (1,963), garden (1,135) and greenhouse (907) purposes.

TABLE XXIII

FARMER, RESEARCH AND DIAGNOSTIC PLANT AND FEED MATERIALS SAMPLES RECEIVED AND AS PERCENTAGES OF TOTAL PLANT AND FEED MATERIALS SAMPLES FOR SPECIFIED PERIODS.

	Plant and Feed Materials			
Period	Farmer (%)	Research (%)	Diagnostic (%)	Totals
1985-86	3,592(21.0)	11,129(65.2)	2,351(13.8)	17,072
1986-87	3,359(24.5)	7,316(53.4)	3,015(22.1)	13,690
1987-88	2,524(19.5)	7,209(55.8)	3,189(24.7)	12,922
1988-89	2,175(18.0)	6,577(54.5)	3,312(27.5)	12,064

Of the 12,064 plant and feed materials samples 2,175 or 18% were farmer related, 6,577 or 54.5% were from research projects and 3,312 or 27.5% were submitted for diagnostic purposes.

Comparison of the 1988-89 data with the three previous fiscal years shows an ongoing decline in farmer submissions for both soils and plant and feed materials. This reflects the increasing use of private sector laboratories by the farming public. Diagnostic submissions are more consistent from year to year. The markedly higher figure for 1988-89 research samples as compared to 1987-88 was the result of late submissions of 1987-88 research project samples.

Tables XXIV and XXV show respectively the number and type of analyses on soil and plant and feed materials for the fiscal years 1985-86 to 1988-89. The analysis listed are those provided in addition to the regular package.

TABLE XXIV

THE NUMBER AND TYPES OF ANALYSES ON SOIL FOR THE SPECIFIED PERIODS

Analyses	Period			
	1985-86	1986-87	1987-88	1988-89
Regular Package+	20,317	19,353	15,325	15,745
Lime	—	—	1,762	135
Organic Matter	—	—	2,003	2,918
Ash	—	—	537	107
Mechanical Analysis	—	—	378	99
Water Absorption	—	—	—	7
Bulk Density	—	—	187	96
Sodium Absorption Ratio (SAR)	—	—	—	380
Exchange Capacity	—	—	—	171
Moisture	—	—	—	822
Total Nitrogen (N)	—	—	—	341
Total Phosphorus (P)	—	—	—	147
Total Sulphur (S)	—	—	—	1
Ammonium (NH_4)	—	—	—	6,002
Calcium (Ca)	—	—	—	1,321
Magnesium (Mg)	—	—	—	1,322
Chloride (Cl)	—	—	—	253
Iron (Fe)	1,380	2,326	1,364	3,102
Manganese (Mn)	1,106	2,470	1,336	3,186
Copper (Cu)	1,016	2,298	1,405	3,396
Zinc (Zn)	999	2,259	1,329	3,082
Boron (B)	412	1,274	1,046	800
Molybdenum (Mo)	92	101	341	402
Miscellaneous*	496	213	325	369

+ Consists of nitrogen (N), phosphorus (P), potassium (K), sulphur (SO_4^{--}-S), pH, salinity, texture and free lime.

* Other analyses performed occasionally such as cobalt (Co), aluminum (Al), lead (Pb), arsenic (As), fluoride (F) and carbonate/bicarbonate (CO_3^{--}/HCO_3^{-}).

— Information unavailable.

TABLE XXV

THE NUMBER AND TYPES OF ANALYSES ON PLANT AND FEED MATERIAL FOR THE SPECIFIED PERIODS.

Analyses	Period 1985-86	1986-87	1987-88	1988-89
Regular Package+	17,072	13,690	12,922	11,936
Carotene	242	213	126	56
Prussic Acid	5	18	15	4
Salt	191	54	482	313
Crude Fat	347	211	374	212
Ash	674	155	1185	592
Acid Detergent Insoluble Protein (ADIP)	290	339	490	676
Crude Fibre	—	—	40	187
Neutral Detergent Fibre (NDF)	813	232	865	635
Lignin	838	80	799	605
Sodium (Na)	1,346	224	249	1,275
Potassium (K)	2,264	1,750	1,595	1,764
Magnesium (Mg)	2,378	1,507	681	1,822
Sulphur (S)	1,805	1,617	1,384	1,888
Selenium (Se)	1,758	2,342	1,226	1,564
Iron (Fe)	1,879	869	730	1,685
Manganese (Mn)	2,087	2,230	1,886	2,945
Copper (Cu)	2,132	2,668	1,999	3,011
Zinc (Zn)	2,139	2,582	1,626	2,988
Boron (B)	1,472	556	929	1,322
Molybdenum (Mo)	1,403	453	217	1,506
Cobalt (Co)	—	—	—	1,202
Aluminum (Al)	1,024	47	8	1,198
Miscellaneous*	216	385	19	71

+ See text
* Other analyses performed include organic matter, cadmium (Cd), lead (Pb), chromium (Cr), nickel (Ni) and arsenic (As).
— Information unavailable.

A regular analyses package for farm and garden soils consists of analysis for nitrogen, phosphorus, potassium, sulphur, pH, salinity, texture and free lime. For greenhouse soils a regular package includes analysis for texture, pH, salinity, ammonium, nitrate, nitrite, chloride, sulphur, phosphorus, potassium, sodium, calcium and magnesium.

A regular analyses package for plant and feed materials consists of the following:

Whole grains - bushel weight, moisture, protein, phosphorus
Roughages - moisture, protein, calcium, phosphorus, fibre (ADF), nitrate, pH (silage only).
Mixed feeds - (processed grains and grain + supplements with less than 25% roughage) moisture, protein, calcium, phosphourus.

Tables XXVI and XXVII provide information on the use of the soils and plant and feed materials diagnostic services by Alberta Agriculture submitters.

TABLE XXVI

SUMMARY OF SUBMITTERS AND THEIR USE OF THE SOILS DIAGNOSTIC SERVICES.

	% Of Total Submissions (Reports) Period			
Submitter	1985-86	1986-87	1987-88	1988-89
1. District Agriculturists/ Fieldmen	42	22	44	52
2. Regional and Other Specialists	21	29	23	18
3. Headquarters Specialists	9	20	17	18
4. Laboratory Staff	28	29	16	12
Number of Reports	(445)	(599)	(351)	(410)

TABLE XXVII

SUMMARY OF SUBMITTERS AND THEIR USE OF THE PLANT AND FEED MATERIALS DIAGNOSTIC SERVICES

Submitter	% Of Total Submissions (Reports) Period			
	1985-86	1986-87	1987-88	1988-89
1. District Agriculturists/ Fieldmen	41	45	32	57
2. Regional and Other Specialists	21	19	43	9
3. Headquarters Specialists	5	2	1	10
4. Laboratory Staff	33	34	24	24
Number of Reports	(905)	(868)	(818)	(714)

District Agriculturists and Fieldmen were the major users of the diagnostic service. Over 50% of the laboratory reports generated were for this category.

Table XXVIII gives a summary of the 1987-88 research projects analyses program. A total of 35 project applications were approved. These projects involved a total of 17,516 samples as compared with 14,227 samples for fiscal year 1987-88. Of the projects, 23 (65%) were from Alberta Agriculture with 62% of the samples, 6 (17%) were from Agriculture Canada with 7% of the samples, 4 (12%) were from the University of Alberta with 26% of the samples and 2 (6%) were from private industry with 5% of the samples.

Projects involved research on several areas of topical interest:

- animal feed quality and evaluation
- updating of irrigated and dryland fertilizer recommendations
- determination of crop irrigation requirements
- intensive crop management systems
- management practices for crops and problem soils.

TABLE XXVIII

SUMMARY - 1988-89 RESEARCH PROJECTS ANALYSIS PROGRAM

Project Number	Researcher and Project Title	Sample Numbers	
		Soils	Plants and Feeds
88-001	Dr. G.W. Mathison, University of Alberta. "Ruminant Feed Evaluation Unit".		415
88-002	Dr. Ross McKenzie, Alberta Agriculture. "Development of Irrigated and Dryland Fertilizer Recommendations".	846	1,039
88-003	Thomas L. Jensen, Alberta Agriculture. "Annual Legume Plowdown to Replace a Cultivated Fallow".	1,967	761
88-004	Dr. J.A. Robertson, University of Alberta. "The Breton Plots. Long Term Effects of Cropping Systems and Fertilizer".	598	
88-005	Dr. Marvin Nyborg, University of Alberta. "Crop Available Nitrogen as Affected by Long Term Cultural Methods and Time of Soil Sampling".	1,883	1,329
88-006	George Grainger, Alberta Agriculture. "Nutrient Study of Woody Plants".	96	96
88-007	Peter Bergen, Alberta Sugar Company. "Reduced Tillage Sugarbeet Production".	36	
88-008	Dr. Susan Hannon, University of Alberta. "Fertilization of the Boreal Forest. Effects on Plant Growth and Use by Herbivores".	259	
88-009	Dr. Vern Baron, Agriculture Canada. "Development of NIRS Calibrations to Describe Forage Fibre in Cereal Species Used for Pasture and Greenfeed".		120
88-010	Jerome Lickacz, Alberta Agriculture. "Liming Acid Soils".	316	

SUMMARY - 1988-89 RESEARCH PROJECTS ANALYSIS PROGRAM (continued)

Project Number	Researcher and Project Title	Sample Numbers: Soils	Sample Numbers: Plants and Feeds
88-011	J. Harapiak, Western Co-operative Fertilizers Ltd. "Long Term Fertilizer Use and Soil Properties".	816	
88-012	Dr. Y.K. Soon, Agriculture Canada. "Crop Residue Management on a Gray Luvisolic Soil".	144	
88-013	Dr. Y. K. Soon, Agriculture Canada. "Crop Rotation on a Gray Luvisolic".	60	
88-014	Abdul Suleiman, Alberta Agriculture. "Range Grass Quality of the Peace River Slopes".		40
88-016	Jerome Lickacz, Alberta Agriculture. "Solonetzic Soils Deep Plowing Feasibility Study".	251	
88-017	Dr. S.S. Malhi, Agriculture Canada. "Fertility Recommendations for Zero Tillage".	336	
88-018	Dr. S.S. Malhi, Agriculture Canada. "Fertility Requirements of Meadow Bromegrass Grown as Pasture in Central Alberta".	104	
88-019	Rick Sherstabetoff, Alberta Agriculture. "Potassium Fertilization for Barley Grown on Organic Soils".	156	100
88-020	Rick Sherstabetoff, Alberta Agriculture. "Characterization of Organic Soils for the Purpose of Improving Fertility Recommendations".	135	
88-021	Rick Sherstabetoff, Alberta Agriculture. "Phosphorus Fertilization for Barley Grown on Organic Soil".	152	100
88-022	Rick Sherstabetoff, Alberta Agriculture. "Copper and Manganese Requirements of Barley Grown on Organic Soil".	75	50
88-023	Rick Sherstabetoff, Alberta Agriculture. "Organic Soil Deep Tillage Feasibility Study".	330	121

SUMMARY - 1988-89 RESEARCH PROJECTS ANALYSIS PROGRAM (continued)

Project Number	Researcher and Project Title	Sample Volume	
		Soils	Plants and Feeds
88-024	D. Penney, Alberta Agriculture. "Soil Test Recommendations for Maximum Economic Yields".	65	630
88-025	D. Penney, Alberta Agriculture. "Intensive Management Systems for Barley, Wheat and Canola Production".	128	766
88-026	D. Penney, Alberta Agriculture. "Copper Fertilizer Requirements of Deficient Mineral Soils".	170	848
88-027	D. Penney, Alberta Agriculture. "(a) Nitrogen Application Methods, (b) Crop Rotation Studies - Lacombe".	144	576
88-028	D. Penney, Alberta Agriculture. "Nitrogen and Phosphorus Fertilization for Pea Production in North Central Alberta".	24	
88-029	Rick Sherstabetoff, Alberta Agriculture. "Effect of Liming Acidic Organic Soils on Crop Growth".	40	30
88-030	H. Najda, Alberta Agriculture. "Grass Seed Production Under Irrigation".	28	
88-031	Dr. Colin McKenzie, Alberta Agriculture. "Irrigation of Safflower".	72	16
88-032	Dr. Colin McKenzie, Alberta Agriculture. "Irrigation of Lentils".	12	32
88-033	Dr. Colin McKenzie, Alberta Agriculture. "Irrigated Alfalfa Forage Production".	72	16
88-034	Dr. Wayne Lindwall, Agriculture Canada. "Furrow Openers for Seed and Fertilizer Placement in Minimum Tillage Systems".	483	

SUMMARY - 1988-89 RESEARCH PROJECTS ANALYSIS PROGRAM (continued)

Project Number	Researcher and Project Title	Sample Volume Soils	Sample Volume Plants and Feeds
88-035	Ken Lopetinsky, Alberta Agriculture. "Pea Project".		633
	TOTAL	9,798	7,718
	OVERALL TOTAL	17,516	

b. **Research Program**

Laboratory research concentrated in three major areas:

1. Development of an adequate database. A current database is essential to enable: credible fertilizer and animal ration recommendations; soil/crop and feed/animal production and health limiting factor identification; adequate definition of nutritive value of feeds; continuing provision of leadership to private agencies in identification, refinement and provision of needed services.

2. Soil test calibration. To maintain and improve the reliability of soil test recommendations.

   Work continued on the development of an automated information processing system for the laboratory. This system is partially in place. It will ultimately enable data capture and directly from analytical instruments and access to data files from remote locations. Close contact was maintained with private sector agencies regarding availability and capability of various systems.

3. Development of a near infrared (NIR) analysis capability. To develop the application of NIR technology to

conduct a range of analyses on a variety of feed materials.

NIR analyses equation development and testing for use on routine feed samples is ongoing. Analyses of cereal and pea grain and straw from research projects for protein and phosphorus is standard procedure. Cooperative work with Alberta Agriculture and Agriculture Canada specialists with development of the NIR instrument capability is in progress.

c. **Technology Transfer Program**

The development and transfer of information and technology to other government departments, universities and private sector agencies.

1. Soil Test Recommendations for Alberta: Extension Manual

This manual provides a detailed description of soil sampling and soil test interpretations and recommendations for Alberta. It is an extension version of the technical manual and is intended for field agrologists and extension agents needing in depth information regarding soil testing.

2. Development of Yield Equations

Equation development, testing and documentation were initiated for a model to predict crop response to fertilizer nitrogen and moisture. Irrigated crop equations have been documented and made available to private sector laboratories. Non-irrigated crop equations are being tested.

3. Methodologies Update

Work was initiated on compiling all laboratory methodologies and procedures.

ALBERTA TREE NURSERY AND HORTICULTURE CENTRE

Summary

The objective of the Alberta Tree Nursery and Horticulture Centre (ATN&HC) is to improve farm family lifestyle and income from horticulture by:

a) Providing extension programs aimed at increasing production.
b) Assisting producers in becoming more competitive.
c) Encouraging diversification into higher income crops.
d) Supplying trees for shelterbelts and farmstead beautification.
e) Providing extension information on maintaining, managing and protecting horticultural plants.
f) Providing support services to horticultural agribusinesses.

Over the past year emphasis was placed on developing a research expertise at ATN&HC. Existing research programs in nursery, vegetable, seed potato, greenhouse and tissue culturing were strengthened and new programs were implemented. In addition, production and extension programs were maintained. Two staff members, Alena Straka and Will Davies, resigned. New staff members are:

Piara Bains, Micropropagation Pathologist; Younus Muhammad, Greenhouse Technician; and Kris Pruski, Tissue Culture Specialist.

BRANCH ACTIVITIES

a. Nursery Production Program

The nursery production section distributed 674,138 shelterbelt trees in 1988-89. This is a reduction of 70% from last year due primarily to the implementation of a charge for these trees. An application fee of $25 plus a per plant charge of 12 to 56¢, dependent upon plant, was implemented in 1988. An additional 41,850 colorado spruce and 3,150 lodgepole pine were distributed to grade one students for Arbor Day.

b. Greenhouse Program

The greenhouse section continued to provide extension and research programs, as well as as tissue culturing services for the seed potato program, the nursery production program and the Alberta Fruit Growers Association. Tissue culturing of saskatoons was maintained at 8,000 plants. One thousand plants of a Polish sour cherry tree were produced for winter hardiness trials in Alberta. This section was also involved with testing and evaluating growth enhancing products.

c. Horticulture Extension Program

An extension program for agribusiness, consumers and users of horticultural plants and products was maintained to ensure consumer satisfaction, greater use of horticultural plants and products ultimately resulting in higher profits to the producer. Demand for this service continued to be high. The horticulture information officer received 5,915 telephone inquiries, 4,077 people used the hortline (a pre-recorded pertinent horticultural message) and 61,030 publications were distributed.

d. Vegetable Program

The vegetable program continued its role in assisting development of the vegetable industry by providing research and extension programs for producers in central and northern Alberta, and by

providing support for Sun-fresh Farms Co-op. The vegetable industry in north-central Alberta is expanding and therefore requires a personalized service. Sun-fresh Farms Co-op assisted by Alberta Agriculture, continued to successfully market local produce.

e. Seed Potato Program

The seed potato program was transferred to ATN&HC in 1988. This program provided 66,125 nuclear and pre-elite seed tubers to producers. Grower extension and research programs continued to receive a high priority. This program continues to be an important link in the expansion of export sales of seed potatoes to the United States Pacific Northwest.

Special emphasis was placed on developing more self-sufficiency in the seed potato industry by encouraging growers to produce their own nuclear and pre-elite seed, rather than relying on government sources. This approach is progressing very well with 4 growers moving towards producing their own nuclear and pre-elite seed potatoes.

f. Micropropagation Pathology Program

Micropropagation pathology is a new program at ATN&HC. This unit is responsible for providing "disease testing" and research support for the seed potato and tissue culturing programs. Emphasis is being placed on research of Rhizoctonia of potatoes.

ALBERTA SPECIAL CROPS AND HORTICULTURAL RESEARCH CENTER

SUMMARY

The Alberta Special Crops and Horticultural Research Center (ASCHRC) is involved in province-wide extension and research activities relating to all areas of horticulture and irrigated speciality crops, in fulfilling its overall crop diversification mandate. Cooperative research projects are conducted in collaboration with personnel from Agriculture Canada, University of Alberta, other Plant Industry Division Branches and the Alberta Environmental Centre, Vegreville.

The extension activities of ASCHRC personnel support and complement extension services provided by the other Alberta Agriculture staff centered in regional and district offices. Contact with both commercial and amateur horticulture clients is assured by maintaining a close working relationship with the industry, input into advisory committee recommendations, and involvement with grower groups and associations. Staff regularly conduct, teach and participate in numerous short courses and seminars held throughout the province. To ensure rapid exchange of information between the producer and the researcher, staff host commodity oriented field days at ASCHRC and participate in similar field days held elsewhere. Membership and active involvement in commodity advisory groups, Agriculture Canada expert committees, and industry-based committees permit the dissemination of applied research information to all sectors of the horticulture and special crops industries.

Programs in 1988-89 continued to emphasize the improvement of management practices for all commodity areas. Variety testing also continued as an important component of most production programs. Crop diversification initiatives occurred with added emphasis on herbs and spices, alternate greenhouse crops and small fruits. The 1988-89 winter resulted in extensive injury to herbaceous perennials and woody ornamentals, further emphasizing a need for cold hardiness research.

BRANCH ACTIVITIES

HORTICULTURAL PRODUCTION SECTION

1. Potato Program

The potato program continued its involvement in the Prairie Regional Potato Trials and the Prairie Potato Breeding Program. The breeding program is expected to "name its first cultivar" in 1989. Seed piece management, including seed size, spacing, dates and depth of seeding continued as the major emphasis of production research in this program. Extension and development activities were centered on existing processors and the Alberta Potato Marketing Board.

2. Vegetable Program

850 cultivars of 18 different vegetables were tested under the cultivar evaluation component of this program. A number of these entries represent advanced breeding lines from Europe and the United States.

Research on the value of "plastics" for frost protection continued. Five treatments, including wall o'water, protecta-cap, hotcap, plastic row covers and floating mulch were evaluated using peppers as a test crop. Fall seeding and succession seeding continued to show applicability to specific crop types and are recommended as management practices in Alberta.

3. Fruit Crops Program

The successful introduction of day-neutral strawberries to Alberta, through this program, has generated a high level of grower interest in the production of these berries. The program is now concentrating on management studies, such as over-wintering, nutrition and the effect of row covers.

Primocane raspberries (fruit bearing on current year's growth) are being introduced. One selection from Agriculture Canada, Morden, shows good possibilities.

The initial writing of the Prairie Strawberry Production Guide was completed.

4. Nursery Crops Program

Research emphasis is being directed to the selection and breeding for improved adaptation of plant material to Alberta climatic conditions. Studies to determine the influence of cultural practices on winter survival and marketability will be stressed. Studies on container production of nursery stock continued, stacking patterns and dormancy, using micro-foam as the protection cover, were evaluated. Involvement continued with the Regional Woody Plant Test Program, the Golden Prairie Arboretum and the Forever Green Pinetum.

5. Greenhouse Crops Program

This program's major focus continued with extension and development in southern Alberta. Research was directed to the use of rockwool as a substrate for vegetable production (cucumber and tomatoes) An alstroemeria demonstration trial, involving 10 cultivars continued. These cut flowers show promise as a new crop in Alberta greenhouses.

SPECIAL CROPS AND AGRONOMY SECTION

1. Special Crops Program

Basic agronomic research was initiated on herbs and spices with funding from Farming for the Future. Essential oil yields and oil quality were also part of this study. This work is being done to support a major interest in commercialization of the crops.

Cultivar testing of dry beans, field peas, sunflowers, lentils, safflower and numerous other special crops continued as major components of this program.

2. Field Crops Program

The field crops program continued its involvement in the cereal and oilseed regional testing programs by operating four southern sites.

Trials were initiated to investigate the potential of producing forage grass seed under irrigation. Included in the trial were meadow foxtail, meadow bromegrass and reed canary grass.

The final evaluation of perennial forage trials seeded in the early 1980's at Brooks and Standard were completed. New variety trials of alfalfa, tall fescue and bromegrass were established for future evaluation.

3. Soil and Water Program

Water use studies with lentils and safflower were continued. Rooting depths for monarda and safflower were measured to assist with future water use studies.

Computerized salinity mapping techniques using a data logger and the EM 38 meter were further refined. The techniques can now adjust salinity readings according to soil temperature, texture and moisture conditions.

CROP PROTECTION AND UTILIZATION PROGRAM

1. Plant Pathology Program

Corky root rot, a relatively new disease of tomatoes in Alberta, was found in three of six commercial greenhouses surveyed. Severity ranged from moderate to high and crop vigor was poor.

Nineteen processing pea varieties were screened for resistance to the root rot disease complex. This work was done in a commercial pea field.

Three fungicides were tested to obtain efficacy on saskatoons. The data generated has been submitted to support registration of the products.

2. Post-Harvest Physiology Program

Disease screening to support the Prairie Potato Breeding Program, for early blight, verticillium wilt, fusarium wilt, rhizoctonia canker, and black scurf was modified.

Commercial potato storages were surveyed for bacterial soft rot and silver scurf.

3. Food Processing and Quality Evaluation Program

The saskatoon cultivar "Smoky" was evaluated for quality of berries out of long term frozen storage. Ten saskatoon cultivars were evaluated for various physical and chemical characteristics.

Fruit and vegetable leathers were produced using saskatoons, carrots, and tomatoes as base products. These products received favorable evaluations by in-house sensory panels.

Support was provided to the Special Crops Program by distilling essential oils from 250 samples of herbs and spices.

4. Weed Control Program

Weed control trials with vegetable crops, included onions, peas, cabbage and squash. These trials evaluated chemical rates and application methods.

Preliminary herbicide tolerance evaluations were done on 13 herb and spice crops with funding from Farming for the Future.

Long term herbicide persistance trials (Glean) applied in 1984, were completed. The 2x rate continued to injure alfalfa, lentils, potatoes and canola.

5. Regional Crops Laboratory Program

1,460 plant disease, insect and plant identification specimens were received in 1988. The ASCHRC information officer handled 6,600 telephone calls.

6. Horticultural Entomology Program

Biological control of the Western Flower Thrip continued as the major component of this program.

The predators Amblyseius cucumeris and Orius tristicolor (Pirate Bug) proved to be effective in some situations.

ADMINISTRATION

The development of long range strategic plans were emphasized. Alberta Public Works Supply and Services, Project Management Division has completed a five year facility plan for the Center. A 5-10 year program plan is being prepared.

Construction of the Hargrave Building addition was initiated. This project will be completed in 1989/90.

Land purchase was completed at Bow Island for the establishment of a permanent sub-station at that location.

A comprehensive description of ASCHRC research, development and extension activities is available by requesting the 1988 Alberta Special Crops and Horticultural Research Center Annual Report, or current copies of the ASCHRC pamphlet series available for all program areas. These are available from the Librarian, ASCHRC, Bag Service 200, Brooks, Alberta TOJ 0J0.

Regional Crop Production Reports

REGIONAL REPORTS

Region I - Lethbridge

Blair Shaw, Regional Crop Production Specialist

Two major factors affecting agriculture in the southern region were insects and a widespread drought.

The severity of the drought adversely affected the cost of production and yields of irrigated crops in many districts. Many crops required germination assistance from very early irrigations. Likewise the need for early watering for first cut hay was underscored by depressed yields from late irrigated fields.

On dryland there were fields which were too poor to justify harvesting. Farmers that used moisture conserving techniques and were favored with a few showers harvested below average crops.

The drought stricken pastures were difficult to utilize efficiently because the source of stock water such as dugouts and dams had received very little runoff since the previous fall.

Thousands of acres of cereals in the northeast part of the County of Vulcan No. 2 were infested with stinkbug providing a challenge both to staff and to farmers. Damage and spread of this insect was minimized by quick action of Plant Industry and Field Services Extension staff working through farm yard meetings, field surveys and extensive use of the media.

The Russian Wheat Aphid arrived in time to cause damage to winter wheat crops in the southern half of the region. The limited spraying which was carried out was effective.

The dryness of the growing season favored perennial weeds and to make matters even worse the uncompetitiveness of drought stunted crops did

not suppress annual weeds. Russian thistle and kochia were a widespread problem by harvest.

The highlight of weed control of 1988 in the southern region was the very successful project which utilized sheep as a biological control agent against leafy spurge.

A newly formed Co-op Seed Cleaning Association was organized in the M.D. of Pincher Creek No. 9 with construction completion slated for early 1989.

Water and wind erosion was less severe this year. Dryland salinity projects were continued and their analysis was broadened to include short term climatic variations.

Maximum economic yield research projects were continued under the leadership of the Soils and the Special Crops Specialists. Farmers are vitally interested in the reduced costs of production and increased efficiencies offered by these projects.

Region II - Airdrie

Larry Welsh, Regional Crop Production Specialist

The spring of 1988 in southern Alberta was warm and extremely dry. Unlike the few previous springs that were also dry there was no soil moisture reserve in 1988. Producers delayed their spring field operations in an effort to keep the seedbed from drying out. Seeding was also delayed in hopes of receiving rain and when it did not come many farmers planted deep to get the seed to moisture. In many cases this was hard if not impossible to achieve. The result was spotty and uneven germination.

As pastures failed to green up farmers were forced to graze their cattle in fall rye and winter wheat fields.

When rains finally did come the first week of June, farmers were faced with an extremely heavy growth of volunteer canola and newly germinated weeds. In mid-June many fields were worked up and reseeded to canola. Emergence of these crops were good but late and early fall frosts were a threat.

Fields which were not reseeded ended up with two or three growth stages of both weeds and crops, making weed control decisions difficult.

Crops suffered from lack of rain in late July. However, rains came in August. Calgary received a monthly total of 165 mm of rain, which is three times more than normal. As a result, crops ripened unevenly and slowly throughout the month of August. Farmers faced the dilemma of when to swath but combining was finally completed under good conditions. Yields and grades were variable. Total production for the region was only about 70% of average. Fall rye and winter wheat crops yielded very poorly as the late rains were unable to help them. From Youngstown, east to the Saskatchewan border, crops were almost a total failure.

Farmers throughout the region expressed little interest in specialty crop production. An exception was field peas which increased to about 14,000 acres. Other specialty crops, including mustard were down slightly in acreage.

The first hay cuts were only 40 to 50% of average. The second cuts were good and together with many greenfeed crops resulted in a good supply of feed being secured for winter.

Canada and sow thistle were major problems in 1988. The early drought stricken crops provided little competition to these deep rooted perennial weeds. The thistle made a major advance and will no doubt cause increased problems in the years to come.

Other crop pests evident were stinkbugs in the M.D. of Wheatland and the diamondback moth larvae in canola crops throughout the region. Throughout the year farmers were warned of the impending threat of the Russian wheat aphid and blackleg of canola. Neither arrived in the region in 1988.

The winter of 1988-89 was cold with good accumulations of snow. Unlike the previous few winters wind erosion was of no significant threat.

Soil conservation practices were strongly encouraged throughout the year by the efforts of the Region II Soil Management Committee. District and regional staff worked closely with and supported the activities of the Alberta Conservation Tillage Society (ACTS). Added support to soil conservation was brought about by funding from the new Canada/Alberta Research and Technology Transfer (CARTT) agreement. A major soil conservation project promoting reduced tillage is planned in the region commencing in the spring of 1989. This will be a cooperative project involving Alberta Agriculture, industry, ACTS and CARTT.

The seed cleaning plant program enjoyed a very successful year in the region. Cleaning volume in the region's 12 plants totalled 5,616,000

bushels as of June 30, 1988 (end of the cleaning year). This volume was up considerably from the previous year. Four plants applied for assistance through the Seed Cleaning upgrading grant program. The Three Hills plant continued with plans to rebuild in 1990-91.

The restricted weeds, nodding thistle, diffuse and spotted knapweed, were again held in check with only a few mop-up problems to deal with.

With the approach of the 1989 crop season farmers are more optimistic than they've been for some time. Good soil moisture and promising markets have given them new hope.

Region III - Red Deer

Wayne Jackson, Regional Crop Production Specialist

For most producers, 1988 will be remembered as the year of the drought. Snow cover was very minimal for the winter and there was virtually no run-off. Conditions remained very dry until mid-June, and below average rainfall was recorded in the eastern half of the region. A few producers near the Saskatchewan border salvaged everything they could as cattle feed and combined nothing. Only in the northwest corner of the region was rainfall adequate to ensure a good crop.

Field Crops

Forage growth was low due to the poor moisture conditions. Grass growth on pastures started slowly and did not regrow when grazed off. Many cattle men were forced to graze hayland, lease additional pasture, or sell cattle in order to accommodate their herd. The second cut of hay was close to normal so feed supplies were adequate for winter in most cases.

Cereal yields were good in the western third of the region but as one travelled east, the yields decreased. Quality was good and markets greatly improved as the year progressed.

Canola acreage remained high as canola prices continued to be strong compared to cereals. Many growers shortened rotations to the point where they were growing canola every second year.

Oat prices and market opportunities have steadily improved in the past two years and growers have developed a renewed interest in producing this crop. However, there is limited acreage suitable for oat production on most farms so the possibilities of capitalizing on this opportunity were limited.

The acreage of field peas increased dramatically as producers found peas to be an excellent way to break cereal rotations. Prices and markets for peas were strong.

Seed cleaning plants had an excellent year with total volume over 5.8 million bushels. Many associations applied for assistance under the Seed Cleaning Upgrading Program to improve facilities.

Soils and Conservation

Ground cover was below average in many fields from the 1987 crop and with the dry conditions of 1988, soil erosion from wind was considerable, especially in the lighter soils of eastern Alberta. Some producers seeded fields up to three times in 1988.

With poor crops for 1988, the erosion potential increased further but many producers did not work fields in the fall just to keep as much stubble standing as possible. Most of those fields had reasonable snow cover at year end so the strategy appears successful.

Because of the dry conditions and poor economic situation, reduced tillage is being considered by most farmers.

Fertilizer use declined slightly in 1988 as the dry sping and low prices dictated reduced inputs. To counter-balance reduced inputs, there was renewed interest in any product that was promoted as a soil conditioner or plant hormone.

Horticulture

Interest continued to expand in vegetable and small fruit production. Markets and marketing remains the big concern to producers.

Tree orders were reduced mainly as a result of the cost associated with tree distribution.

Pest Control

Pests were minimal in cereal and oilseed crops for 1988. Grasshopper numbers were down and few problems arose in canola fields. A few concerns were raised over diamondback moths but virtually no spraying was needed.

Forest tent caterpillars remained a nuisance in eastern districts.

Virulent blackleg of canola was positively identified in the region in three jurisdictions. Extensive efforts to educate producers to the dangers of blackleg were put forward.

Weed Control

Annual weeds were the same as in previous years but the perennial weeds provided strong competition in the dry conditions and continued to increase. Canada thistle, toadflax, quackgrass and scentless chamomile continue to be a problem. Stork's-bill spread rapidly in canola fields and is becoming a major concern.

Extension

Demand for short courses was strong. Continued emphasis was on the economics association with production as the cost/price squeeze was tight at the beginning of the year.

Economic Situation

Prices remained low and outlook poor at the beginning of the year. However, things improved toward spring and by year end, outlook was good for those who had crop to sell. Many producers are still in financial difficulty but the mood was much more optimistic by year end.

Region IV - Vermilion

E. Treffry, Regional Crop Production Specialist
B. Berg, Regional Forage Specialist

The following is a short summary of some of the major trends and concerns in the Plant Industry sector during 1988 in Region IV.

Field Crops

The growing season was variable with an extremely dry May and June followed by improved growing conditions over much of the region during the summer. However, rains were hit and miss resulting in variable yields depending on the district and the rain received. A good harvest season helped farmers to obtain crops of good grade and quality.

Interest was evident in field peas with several demonstration plots in the region drawing keen interest from farmers. A farmer from Region IV was elected to the Board of Directors of the Central Alberta Pulse Growers Association. This will enable the Association and farmers to develop and promote the industry in the region.

A new seed cleaning plant was built and opened at Willingdon. It will serve farmers in adjoining parts of the counties of Two Hills, Lamont and Vegreville.

The Cereal and Oilseed Variety Testing Program received high interest and praise from producers. The summer tours and plot results all followed with increasingly keen interest. The results over time have become very useful for producers.

The fall and winter saw poor soil moisture, limited snow cover and the prospect of dry conditions in the spring of 1989.

Soils

An extension effort in the area of soil conservation, tillage and management was undertaken in counties of Beaver and St. Paul and the M.D. of Wainwright during the winter months. Farmers attending showed concern about the dry conditions and the need for soil and moisture conservation. A followup in 1989 will involve a demonstration of conservation fallow using a wide blade cultivator and herbicides in the M.D.'s of Wainwright and Provost and the counties of Vermilion River and Provost.

Much farmer interest exists regarding the deep ripping of soils. A major concern is which soils should be ripped.

A serious situation occurred during May and June with wind erosion of newly seeded fields. Instances of reseeding, loss of topsoil from knolls, etc. occurred. This situation served as an awareness for farmers of the possible seriousness of the problem of soil erosion.

A successful MEY (Maximum Economic Yield) plot was situated in the Tofield area. One year's work indicates the great influence of moisture on the results from high fertilizer rates, growth regulators and fungicides. Additional demonstration and assessment is required.

Pest Control

The concern about virulent blackleg in canola continued to grow in the eastern half of Region IV. The major problem is short rotations involving canola. An extension program along with the provincial Blackleg Program was used to make producers aware of the problem and to address the problems of testing seed for disease treating all canola seed and lengthening crop rotation involving canola.

The diamondback moth infected crops in the M.D.'s of Provost, Wainwright and Vermilion River. Some spraying was done but the outbreak was not as bad as expected.

A major concern emerging in weed control is the effect of chemical residues on succeeding crops, the possible resistance of some weeds to particular families of herbicides and the large number of herbicides from which to choose.

Horticulture

A study was initiated in Region IV by the Horticulture Branch in the region to assess field shelterbelts. Two sites were selected in the Vermilion and St. Paul areas and these will be monitored for several years. A need exists to convince farmers of the need of field shelterbelts and how to use them for effectiveness and convenience. This study can help to overcome this problem.

Forage Crop Conditions and Production

The extremely dry conditions resulted in a high demand for extra hay and spring pasture especially in the central districts. First cut hay crops were below normal and heavy rains resulted in significant rain damage in some western districts. The rains continued through July in eastern and western districts, but avoided the central part of the region, resulting in good hay supplies by the end of August for the region as a whole, but with feed shortages in the central area. Hay prices were average, $40 to $70 per ton.

Pastures in the central part of the region were over used by late August because of the drought. Native range suffered the most.

Forage seed prices remained high and with spring drought conditions, forage seedings were either set back or curtailed. By March 1989, seed prices had dropped significantly especially for brome and crested wheatgrass varieties.

Forage Demonstrations and Extension

Continued interest exists in intensive grazing systems in the region. Many of the farm calls and extension meetings conducted this year were aimed at planning these systems. A cooperative demonstration project was initiated at Elk Point with Ducks Unlimited to show wetland conservationists and producers how such a system could operate.

Two silage projects were completed during the year. A video on silage production was taped and distributed throughout the province. Following successful trials of the heap silage method in other regions, a demonstration project on this specialized method of making silage was conducted in two districts.

The hay auction originally sponsored by the department in 1986 at Bonnyville has had a major impact on hay sales in the region. This year, besides this auction, two other auctions were held and one hay sale.

Region V - Barrhead

Bill Chapman, Regional Crop Production Specialist

Higher grain prices increased net returns on crops to profitable levels. Crop production in the region accounted for 95 to 105 percent of the five year average 1983 to 1987. Seeded acreage changed as wheat acreage increased to 105 percent, barley was at 95 percent, oats at 106 percent and canola at 110 percent of five year average acreages 1983 to 1987. Total growing season precipitation ranged from 12 to 20" (30 to 50 cm). Crop yields in the region were variable; on canola 95% (22 bu/ac), wheat 105% (42 bu/ac), oats 105% (78 bu/ac), and barley 105% (65 bu/ac) cereals 100 to 105% of recent 5 year averages.

Considering farmers were faced with a drier spring again in 1988 and late rains, crop yields maximized soil moisture reserves. Crop quality was better overall as there was a large increase in malt barley sold. On average 2.5 percent of production is accepted for malt which is fifty to sixty carloads. In 1988, 220 cars were selected (360% increase). Grades of hard red spring wheat was also higher 35% 2 CWHRS, 50% 3 CWHRS. Germination of pedigreed seed was normal in the 90 plus percent range. The only harvesting problems reported were due to wind damage shattering up to 10% of canola swaths in the region. Canola graded over 80% #1, 15% #2, and 5% sample.

The market development of pony oats has paid off for farmers. Oats were again worth more than barley in 1988. This competitive market still has growth opportunities in the U.S. By maintaining our superior quality for milling and pony oats Alberta was able to market 200 percent more than last year (just over 100,000 metric tonnes from the region). Total acreage was up to 300,000 acres.

The extension programs were modified from general production topics to keys on marketing and new opportunities like pony oats. Farmer numbers were down as more continued or started off farm jobs. The number of meetings that a farmer could attend was large. Economics - agronomics

were presented with all production practices as the maximum profit/benefit was the primary objective. Soil conservation was also discussed at a number of meetings. The main change in this area has been farmers attitudes to soil conservation awareness. Most farmers are improving efforts in this area.

Joint meetings were held with Alberta Canola Growers in Morinville and Josephburg and Western Barley Growers Associations in Westlock. Both associations cooperated at other smaller producer meetings.

The increase in members with crop clubs has modified the large meeting approach to smaller groups. Two clubs in Athabasca and Leduc have increased their total membership. The Pro Gro Canola Club in Fort Saskatchewan still remains the most intensive on canola. The Pembina Crop Club in Westlock is improving with every meeting. A new marketing production Club has been started in Fort Saskatchewan by Superior Agri-Services in cooperation with our district office.

Agricultural service boards in the region carried out a large number of projects and plots. District staff have put extra efforts into these projects, accompanying tours and plot results. Excellent plot reports were circulated by staff from Stony Plain, Sangudo, Edson, Westlock, Morinville, Leduc and Athabasca. Boards have changed their focus to move out of drainage and into farm water management.

Seed cleaning plant volume for the 10 regional plants in 1987 to 1988 year ending June 30, 1988 was 4,490,484 bushels, 3,768,230 bushels was seed. Dockage removal and separation was 722,254 bushels and pedigreed seed was 597,081. The regional plants cleaned 17 percent of provincial volume 4.7% of provincial pedigree seed totals. Two key plants, Morinville and Stony Plain, have capitalized on this market of separations with volume of over one million bushels. Morinville was the first provincial plant to clean one million bushels in volume for the second consecutive year.

Major upgradings occurred at Gibbons - $160,000 and a few other plants had $20 to 40,000 upgrades on equipment at Radway and Morinville. Boyle is planning to start the new plant in the summer of '89. Morinville is also planning a $400,000 expansion to clean peas in 89/90.

The North West Peat Soils Association has been increasing activities in Barrhead-Westlock-Athabasca and Lac St. Anne areas. Directors for the association have been active in promoting the objectives to Ag. Service Boards and interested farmers. In the past year a soil temperature monitoring on farm demo project continued on the deep plowed sites. The first year results showed higher yields on the plowed treatments by 20 percent on barley and 25 percent on canola, but little difference in yield was noted in '88. The Association is also working closely with the County of Barrhead on cereal and forage plots, and the M.D. of Westlock on macro and micronutrient fertility plots.

To complete the associations activities the members Trust Fund was used to purchase a plow from California. The cost of the 4' plow was $12,500 plus $1,200 freight to Barrhead. Plans are to plow more demo plots in '89 prior to plowing trust fund members land.

Region VI - Fairview

Mike Rudakewich, Regional Crop Production Specialist

For the ninth consecutive year wheat was one of the major seeded crops in the Peace. Crops of similar magnitude in 1988 were forage and canola. Farmers were pleased with the fine harvest weather that contributed to good quality crops.

Cereals and Oilseeds

Wheat was the major winner! Many farmers produced their best crop ever in 1988. The better wheat crops ranged from 35-45 bu/ac and the majority of grades were #2 and #3 C.R.S.

Barley acreages were reduced by 46% from 1987 and fallow acres increased by 16%. This may be partly attributed to excessive rain during the latter half of May and first half of June in which two weeks of seeding time were lost.

A significant amount of high quality malt barley was harvested and marketed to various malt houses. Oat crops yielded well and were of high quality. Considerable volumes of oats were sold into milling oats and pony oat markets.

In parts of I.D. #19 and other smaller areas, yields of canola were disappointing. High rainfall from mid May to July 7th caused very high levels of root rot at critical growth stages of canola. Yields in the "excessive rainfall areas" were subsequently reduced by an estimated 40%.

Forage Seed Crops

Forage crop acreage reached an all time high of 930,000 acres in 1988, an estimate of one half was intended for seed crop purposes. It is expected that substantial forage acres will be plowed under in 1989 and 1990 due to low seed prices and a major improvement in grain prices.

Special Crops

The strong interest in field pea production continued into 1988. It is estimated the acreage was trebled from 1987 to a total of 35,000 acres in 1988 which may become a "high" for the Peace.

Extension Activities

Crop Production - Because of the unusual number of promising new varieties in cereals and oilseeds a concerted effort was made to provide broad coverage on test results, adaptation and other characteristics of all new varieties. Workshops were conducted on malting barley selection. There appears to be a certain number of producers that are intent on making malting barley their specialty.

Forage Production - One of the largest acreages of red clover crop was grown in 1988 and much of it was plowed down for green manure. The regional extension program on legume plowdown was quite extensive starting in 1987 and continued through 1988. An additional dimension was incorporated into the program in 1988 to provide for perennial weed control.

Canola Production - The Alberta Canola Council has become well recognized for its contribution to the improvement in canola production. Our major role is to work jointly with the Grow with Canola program field trials and jointly participate in extension meetings. A cooperative effort with the Crop Protection Branch, the Alberta Canola Growers and the Federal Plant Products Division culminated in a provincial Blackleg of Canola control program. It will now be put to its ultimate test starting in 1989.

Weed Control - Continued support and emphasis was placed on the major weed problems in which Agricultural Service Boards were involved. The major activities in 1988 focussed on training weed inspectors, demonstrations in conjunction with Ag. Fieldmen and participation in the regional committee on enforcement.

Special Crops - Field peas continue to monopolize the interest in this area. A series of meetings were conducted in the region with a high level of interest but a reduced number of producers.

Seed Cleaning Plants - A total of 24 seed plants were inspected this past season. The seed cleaning plants in the inspection program included 15 municipal, and nine private operations.

Demonstrations, Field Trials

This area of activity continues to hold a high profile for producers, industry and research stations. Demonstrations are therefore increasing in number, quality and reliability.

Canola Thistle Control - The three year field trial at Eaglesham was completed in 1988. The central conclusion was that in a full fallow year, tillage alone, if done thoroughly, but limited to two or three times per year could reduce thistle populations from 60-95% for the following year. The addition of most herbicides at field rates did little to add to the effectiveness of tillage alone.

Legume Plowdown - The legume plowdown trial at Fairview showed yields of wheat and barley were higher on plowdown of red clover than on sweet clover. Canola was also grown successfully on legume plowdown of red clover, alfalfa and sweet clover. Heavy winds rolled the canola swaths and individual plot yields could not be sorted out. In a salvage effort the threshed canola still averaged 16 bushels per acre on legume plowdown compared to 6.9 bushels on fallow. Sustained heavy rainfall was received at this plot site for much of the growing season.

Inventory of Research Projects

PROJECT TITLE	TRIAL LOCATION	RESEARCHERS	AGENCY	STATUS AND REPORTED	PMY	TMY
Development of new 6-row feed barley varieties for Alberta	Irrigation 1 site Area 1, 1 site Area 2, 1 site Area 3, 1 site Area 4, 4 sites Area 5, 2 sites Saskatchewan, 1 site	J. Helm	Field Crops	Ongoing Annual Report Field Crops Library Agriculture Library	0.2	2.0
Development of new 2-row feed barley varieties for Alberta	Irrigation 1 site Area 1, 1 site Area 2, 1 site Area 3, 1 site Area 4, 4 sites Area 5, 2 sites Saskatchewan, 1 site	J. Helm	Field Crops	Ongoing Annual Report Field Crops Library Agriculture Library	0.2	2.0
Development of high lysine and hulless barley varieties which have improved feeding value.	Irrigation 1 site Area 1, 1 site Area 2, 1 site Area 3, 1 site Area 4, 4 sites Area 5, 2 sites Saskatchewan, 1 site	J. Helm	Field Crops	Ongoing Annual Report Field Crops Library Agriculture Library	0.1	0.5
Barley germplasm creation and maintenance.	Lacombe	J. Helm	Field Crops	Ongoing	0.1	0.9
The heritibility of straw strength in Samson and other semi-dwarf barleys	Lacombe	J. Helm	Field Crops	Ongoing	0.1	0.1

CEREALS AND OILSEEDS (continued)

PROJECT TITLE	TRIAL LOCATION	RESEARCHERS	AGENCY	STATUS AND REPORTED	PMY	TMY
Cereal and Oilseed Regional Variety trials on Barley, Wheat, Oats, Flax, & Canola	Irrigation 4 sites Area 1, 4 sites Area 2, 3 sites Area 3, 4 sites Area 4, 6 sites Area 5, 7 sites Area 6, 5 sites	J. Helm D. Salmon B.Wolfe K. Briggs D. McAndrew S. Kibite R. Gaudiel K. May	Field Crops Field Crops Ag. Canada U. of A. Ag. Canada Ag. Canada AHRC Ag. Canada	Ongoing, Reported Annual Report Cereal & Oilseeds Advisory Committee Report in all Research Libraries in Western Canada	0.1	1.2
Intensive management systems for barley and wheat F.F.F.	Lacombe	J. Helm D. Penny	Field Crops Soils production	Report to F.F.F.	0.1	0.7
Development of new spring triticale varieties	Irrigation 1 site Area 2, 1 site Area 3, 2 sites Area 4, 3 sites Saskatchewan 2 sites	D. Salmon	Field Crops	Ongoing Annual Report Field Crops & Ag. Dept. Libraries	0.35	1.9
Germplasm development and evaluation in Spring Triticale	Lacombe	D. Salmon			0.1	0.2
Evaluation of Winter Cereals for forage potential	Lacombe Brooks	D. Salmon J. Helm V. Baron	Field Crops Ag. Canada	Ongoing Annual Report FFF Report	0.1	0.1

CEREALS AND OILSEEDS (continued)

PROJECT TITLE	TRIAL LOCATION	RESEARCHERS	AGENCY	STATUS AND REPORTED	PMY	TMY
Development of improved varieties of winter wheat and triticale	Lacombe Brooks Lethbridge Olds Trochu Saskatchewan 3 sites	D. Salmon J. Helm	Field Crops	Ongoing Annual Report Field Crops & Ag. Dept Libraries	0.4	1.7
Germplasm development and evaluation in winter wheat and triticale	Lacombe	D. Salmon	Field Crops	Ongoing	0.1	0.2
Seeding Rate influence on Spring Triticale	Lacombe Provost Olds, Trochu Drumheller	D. Salmon	Field Crops	Ongoing Annual Report Field Crop & Ag. Dept. Libraries	0.05	0.05
Identification of lines of barley, triticale and winter wheat with improved levels of post harvest dormacy	Lacombe	D. Salmon J. Helm	Field Crops	Ongoing Published Crop Science Annual Report	0.1	0.2
Silage production of barley and triticale	Lacombe	J. Helm D. Salmon	Field Crops Field Crops	Ongoing Annual Report Field Crops & Ag. Dept. Libraries	0.1	0.2

CEREALS AND OILSEEDS (continued)

PROJECT TITLE	TRIAL LOCATION	RESEARCHERS	AGENCY	STATUS AND REPORTED	PMY	TMY
Intensive cereal management in barley	Lacombe	J. Helm	Field Crops	Ongoing Annual Report	0.1	0.5
Screening barley and Triticale for root rot resistance	Lacombe	J. Helm D. Salmon	Field Crops	Ongoing	0.1	0.4
Screening barley and triticale for foliar disease resistance	Lacombe Calmar Olds Trochu	J. Helm D. Salmon	Field Crops	Ongoing	0.1	0.5
Cultural practices associated with winter cereal production	Lacombe	D. Salmon J. Helm	Field Crops	Ongoing	0.1	0.5
Crop Rotation in cereals	Lacombe	J. Helm	Field Crops	Ongoing Arnual Report	0.1	0.3
Yield losses due to lodging in barley	Lacombe	J. Helm D. Salmon	Field Crops	Ongoing Annual Report	0.1	0.2
Special Crops agronomics for Central and North Central Alberta	Lacombe Stettler Calmar Vermilion	J. Helm R. Park R. Gaudiel	Field Crops F.F.F. AHRC	Ongoing F.F.F.	0.2	2.5

VEGETABLES AND POTATOES

PROJECT TITLE	TRIAL LOCATION	RESEARCHERS	AGENCY	STATUS AND REPORTED	PMY	TMY
Seed Potato Density Trial	Edmonton	K. Pruski M. Mirza	ATN&HC	Continuing	0.21	1.0
Studies on Stem Canker and Black Scurf Caused by Rhizoctonia solani	Edmonton	P. Bains J. Letal	ATN&HC	Continuing*	0.2	0.8
Tissue Culture of Seed Potatoes	Edmonton	P. Bains J. Letal	ATN&HC	Continuing*	0.2	0.3
Alfalfa Pellets as a Soil Amendment and Organic Fertilizer	Edmonton	B. Choban	ATN&HC	Complete* ('88)	0.02	0.1
Vegetable Cultivar Trials for Cabbage, Broccoli Cauliflower, Brussels Sprouts, Snow Peas and Chinese Vegetables	Edmonton	B. Choban	ATN&HC	Complete* ('88)	0.04	0.4
Cabbage Cultivar Trial	Dunvegan	B. Choban	ATN&HC	Complete* ('88)	0.02	0.05
Cos (Romaine) Lettuce Spacing Trial	Edmonton	B. Choban	ATN&HC			
Succession Seeding:						
Cos (Romaine) Lettuce	Edmonton	B. Choban	ATN&HC	Complete*	0.04	0.3

*Trial results reported in the Alberta Tree Nursery & Horticulture Centre Annual Report.

VEGETABLES AND POTATOES (continued)

PROJECT TITLE	TRIAL LOCATION	RESEARCHERS	AGENCY	STATUS AND REPORTED	PMY	TMY
Head Lettuce	Edmonton	B. Choban	ATN&HC	Complete*	0.04	0.3
Spinach	Edmonton	B. Choban	ATN&HC	Complete*	0.04	0.3
Carrots - raised seed beds versus flat seed bed	Edmonton	B. Choban	ATN&HC	Complete*	0.02	0.2

*Trial results reported in the Alberta Tree Nursery & Horticulture Centre Annual Report.

ORNAMENTALS, TREES AND SHELTERBELTS

PROJECT TITLE	TRIAL LOCATION	RESEARCHERS	AGENCY	STATUS AND REPORTED	PMY	TMY
Nutrient Study for Woody Plants	Edmonton	B. Casement	ATN&HC	Continuing	0.02	0.03
Prairie Regional Trial for Woody Ornamentals	Edmonton	B. Casement	CDS, Morden	Continuing	0.02	0.02
Regional Woody Plant Test Program	Grande Prairie Edmonton Bowden Calgary Brooks Coaldale	B. Rogerson B. Casement D. Berggren H. Heuver H. Mathers H. Kuperus		Annually to Committee Advisory meetings, Commodity Group meetings and Annual Report.	0.05	0.10
Plant Introduction Scheme from the University of British Columbia Botanic Garden	Edmonton	B. McDonald B. Casement	U.B.C. ATN&HC	Continuing Continuing	-- included in PRT	--
Humalite Trial on Poplar Cuttings	Edmonton	B. Casement B. Breneman	ATN&HC	Continuing	0.01	0.01
Humalite Trial in Containers	Edmonton	B. Casement C. McIsaac	ATN&HC	Continuing	0.01	0.01
Effects of Alfalfa Pellets on Growth of White Spruce and Scots Pine	Edmonton	B. Casement B. Breneman	ATN&HC	Continuing	0.01	0.01
All American Selections Annual Flower Trial	Edmonton	B. Casement	AAS Committee	Continuing (to AAS Committee annually)	0.03	0.01

ORNAMENTALS, TREES AND SHELTERBELTS (continued)

PROJECT TITLE	TRIAL LOCATION	RESEARCHERS	AGENCY	STATUS AND REPORTED	PMY	TMY
Micropropagation of Purple Leaf Birch	Edmonton	K. Pruski M. Younus M. Mirza	ATN&HC	Complete	0.03 0.01	0.01
Micropropagation of Purple Leaf Birch	Edmonton	K. Pruski M. Younus M. Mirza	ATN&HC	Complete	0.03 0.01	0.01
Micropropagation of Difficult to Root Geraniums	Edmonton	K. Pruski M. Mirza	ATN&HC	Continuing	0.05 0.01	
Alfalfa Pellets as a Nitrogen Source for Turf	Edmonton	B. Vladicka M. Olesky	ATN&HC	Complete*	0.125	0.25

*Trial results reported in the Alberta Tree Nursery & Horticulture Centre Annual Report.

FRUIT CROPS

PROJECT TITLE	TRIAL LOCATION	RESEARCHERS	AGENCY	STATUS AND REPORTED	PMY	TMY
Association of Saskatoon Roots with Fungi	Edmonton	P. Bains	ATN&HC	Continuing*	0.2	0.3
Micropropagation Pathology of Saskatoons	Edmonton	P. Bains	ATN&HC	Continuing*	0.1	0.2
Production of Saskatoons Through Tissue Culture	Edmonton	K. Pruski S. Pietucha	ATN&HC	Continuing (15,000 micropropagated plants were produced from 1987 to 1989)	0.5	2.0
Saskatoon Rooting Trial (in vitro)	Edmonton	K. Pruski S. Pietucha M. Mirza	ATN&HC	Continuing	0.1 0.1	0.5
Micropropagation of Fruit Crops (Mongolian cherries, sour cherries, raspberries)	Edmonton	K. Pruski S. Pietucha R. Hughes M. Mirza	ATN&HC	Continuing	0.1 0.01	0.1 1.0
Micropathology of Saskatoons	Edmonton	P. Bains K. Pruski M. Mirza	ATN&HC	Continuing	0.02 0.02 0.01	
Dormancy in Saskatoon Plantlets	Edmonton	K. Pruski S. Pietucha M. Mirza L. Ozimek	ATN&HC	Continuing	0.2 0.01 0.05	0.5

*Trial results reported in the Alberta Tree Nursery & Horticulture Centre Annual Report.

GREENHOUSE CROPS

PROJECT TITLE	TRIAL LOCATION	RESEARCHERS	AGENCY	STATUS AND REPORTED	PMY	TMY
Evaluation of a Bacillus sp. as an antagonist to Pythium in NFT System	Edmonton	K. Chang M. Younus M. Mirza	ATN&HC	Continuing	1.0 0.05	0.3
Evaluation of Tomato Cultivars in NFT System	Edmonton	M. Younus	ATN&HC	Continuing	0.05	0.2
Evaluation of Peppers as an Economical Crop in NFT System	Edmonton	M. Younus	ATN&HC	Continuing	0.05	0.2
Effects of Growth Regulators on Fibrous Begonias	Edmonton	M. Younus M. Mirza	ATN&HC	Complete*	0.01	0.1
Observations on Alstromerias as a Cut Flower Under Warm Temperatures	Edmonton	M. Younus K. Pruski	ATN&HC	Continuing	0.05 0.01	0.1
Seedless Cucumbers Spacing	Edmonton	K. Pruski M. Younus M. Mirza	ATN&HC	Complete*	0.05 0.01	0.02
Evaluation of Humate and Humalite as a growing Medium Amendment	Edmonton	M. Younus M. Mirza	ATN&HC	Continuing	0.01	0.02

*Trial results reported in the Alberta Tree Nursery & Horticulture Centre Annual Report.

SOIL FERTILITY AND SOIL IMPROVEMENT

PROJECT TITLE	TRIAL LOCATION	RESEARCHERS	AGENCY	STATUS AND REPORTED	PMY	TMY
Fertilizer requirements of irrigated grains and oilseeds	2 major locations 3 locations on-farm	R.H. McKenzie J. Carefoot	Soils Branch Agric. Canada FFF funded	Field research complete Final report pending	0.30	1.50
Fertilizer requirements dryland crops	12 major locations in Region I and II	R.H. McKenzie H.H. Jantzen	Soils Branch Agric. Canada	Ongoing - FFF funded	0.20	0.40
Intensive Crop Management systems for wheat and barley under irrigated and dryland conditions	4 locations	R.H. McKenzie D. Penney E. Solberg J. Helm	Soils Branch Soils Branch Soils Branch Field Crops	Ongoing, Poster Paper Barley Symposium, Saskatoon and Research Report to FFF	1.0	3.00
Soil phosphorus cycling and development of a laboratory test for soil phosphorus	Laboratory Project	R.H. McKenzie J.F. Dormaar J.W.B. Stewart	Soils Branch Agric. Canada Univ. of Sask.	Ongoing	0.20	1.50
Fertilizer and other input requirements for maximum economic yield	3 locations	E. Solberg D. Penney	Soils Branch	Ongoing	0.40	1.00
The extent and location of Cu deficient soils	4 field experiments 20 field surveys	D. Penney E. Solberg L. Kryzanowski	Soils Branch Soils Branch Soils & Animal Nutrition Lab.	Ongoing	0.30	0.50
Technolgies for post seeding application of fertilizer N	5 locations	E. Solberg D. Penney J. Ashworth	Soils Branch Soils Branch Norwest Labs	Ongoing	0.20	0.50

SOIL FERTILITY AND SOIL IMPROVEMENT (continued)

PROJECT TITLE	TRIAL LOCATION	RESEARCHERS	AGENCY	STATUS AND REPORTED	PMY	TMY
Spoke injection of fertilizer N in established minimum tillage systems	1 location	M. Nyborg E. Solberg	Univ. of Alberta Soils Branch	Ongoing	0.10	0.25
Spring and fall N spoke injection and broadcast methods of fertilizer N applications	2 locations	M. Nyborg E. Solberg	Univ. of Alberta Soils Branch	Ongoing	0.20	0.25
N dynamics of mature straw tillage systems	1 location	M. Nyborg E. Solberg D. Heaney	Univ. of Alberta Soils Branch Univ. of Alberta	Ongoing	0.30	0.25
Assessment of deep plowing, ripping and the application of amendments for improving crop growth on Solonetzic soils	46 locations	J. Lickacz	Soils Branch	Ongoing	0.50	0.50
Crop responses to liming and ripping of luvisolic soils	9 locations	J. Lickacz	Soils Branch	Ongoing	0.05	0.05
Nutrient requirements, crop adaptation and deep plowing feasibility of organic soils	13 locations	R. Sherstabetoff	Soils Branch	Ongoing	0.50	0.70

WEED CONTROL

PROJECT TITLE	TRIAL LOCATION	RESEARCHERS	AGENCY	STATUS AND REPORTED	PMY	TMY
Weed control in potatoes	Brooks	R. Esau	ASCHRC	Active ASCHRC Annual Report 1987 Expert Committee on Weeds	0.20	0.23
Herbicide residues in crop rotation	Brooks	R. Esau	ASCHRC	ASCHRC Annual Report 1987 Expert Committee on Weeds	0.08	0.07
Application of herbicides through irrigation systems	Brooks	R. Esau	ASCHRC	Active Expert Committee on Weeds	0.03	0.07

WEED RESEARCH & DEVELOPMENT

Round-leaved mallow control - in wheat. Biological and chemical	Acme Rosebud	D. Maurice	Crop Protection Branch	Expert Committee on Weeds - Research Report 1987 1987 Research Results - Crop Protection Branch	.007	0.02
Scentless chamomile control - in cereals	St. Francis Leduc Bezanson Falher	D. Maurice	Crop Protection Branch	ECW Research Report 1988 1988 Research Results - Crop Protection Branch	0.005 0.005 0.005	0.02 0.02 0.02
Milkweed Control	Duchess Complete	D. Maurice	Crop Protection Branch	On-going project ECW Research Results 1988 Research Results - Crop Protection Branch	0.005	0.008

WEED RESEARCH & DEVELOPMENT (continued)

PROJECT TITLE	TRIAL LOCATION	RESEARCHERS	AGENCY	STATUS AND REPORTED	PMY	TMY
Ox-eye Daisy Control - in established mixed forage - in established pasture	Buck Lake Edson	D. Maurice	Crop Protection Branch	On-going project ECW Research Report 1988 1988 Research Results - Crop Protection Branch	0.005 0.005	0.02 0.02
Control of toadflax in crop and summerfallow	Blackie Mannville	D. Maurice	Crop Protection Branch	On-going project ECW Research Report 1988 1988 Research Results - Crop Protection Branch	0.005	0.02
Sulfonylurea - resistant chickweed control	Stony Plain	D. Maurice	Crop Protection Branch	Active Expert Committee on Weeds	0.10	0.02
Grassy weed control in field peas	Morinville	D. Maurice	Crop Protection Branch	Active Expert Committee on Weeds	0.10	0.02
Broadleaved weed control in field peas	Morinville	D. Maurice	Crop Protection Branch	Active Expert Committee on Weeds	0.10	0.02
Spreading dogbane control in summerfallow	Red Deer	D. Maurice	Crop Protection Branch	Active Expert Committee on Weeds	0.10	0.02
Pasture Sage Control - in native pasture	Irricana Three Hills	D. Maurice	Crop Protection Branch	On-going project ECW Research Report 1987 1987 Research Results - Crop Protection Branch	0.005 0.005	0.02 0.02

WEED RESEARCH & DEVELOPMENT (continued)

PROJECT TITLE	TRIAL LOCATION	RESEARCHERS	AGENCY	STATUS AND REPORTED	PMY	TMY
Tansy Control - in non-cropland - in a grass hayfield - on roadside	Fallis	D. Maurice	Crop Protection Branch	Stony Plain and Athabasca sites - on-going projects ECW Research Report 1987 1987 Research Results - Crop Protection Branch	0.002 0.002 0.002	0.01 0.01 0.01
Tall Buttercup Control - in pasture	Winfield Complete	D. Maurice	Crop Protection Branch	ECW Research Report 1987 1987 Research Results Crop Protection Branch	0.002	0.08
Scentless Chamomile Control - in established alfalfa - in established alfalfa - in established clover	Calmar Leduc Bezanson	D. Cole	Crop Protection Branch	ECW Research Report 1988 On-going project On-going project	0.002 0.005 0.005	0.02 0.02 0.02
Toadflax Control - in established alfalfa - in established alfalfa	Stettler Stettler	D. Cole	Crop Protection Branch	ECW Research Report 1988 On-going project	0.005 0.005	0.01 0.02
White Cockle Control - in a mixed forage stand - in established alfalfa	Alhambra Nisku	D. Cole	Crop Protection Branch	On-going project ECW Research Report 1988 On-going project	0.005 0.005	0.02 0.02
Seedling grass tolerance - to herbicides	Edmonton	D. Cole/ Darwent	Crop Protection Branch Agriculture Can. Beaverlodge	On-going project ECW Research Report 1988	0.01	0.03
Seedling legume tolerance - to herbicides	Edmonton	D. Cole L. Darwent	Crop Protection Branch Agriculture Can. Beaverlodge	On-going project ECW Research Report 1988	0.01	0.03

WEED RESEARCH & DEVELOPMENT (continued)

PROJECT TITLE	TRIAL LOCATION	RESEARCHERS	AGENCY	STATUS AND REPORTED	PMY	TMY
Established grass tolerance - to herbicides	Edmonton	D. Cole L. Darwent	Crop Protection Branch Agriculture Can. Beaverlodge	ECW Research Report 1988	0.005	0.02
Inactivation of soil residual herbicides	Tofield Namao Complete	D. Maurice/ Industrial Vegetation Management Asso. of Alberta	Crop Protection Branch IVMAA	Tofield site - on-going IVMAA Field Manual	0.005 0.005	0.01 0.03
Alfalfa-brome Establishment - with and without herbicides - with and without a cover crop	Edmonton	D. Cole J. Moyer	Crop Protection Branch Agriculture Canada Beaverlodge	On-going project	0.02	0.04
Chemical-fallow	Daysland	D. Cole	Crop Protection Branch	ECW Research Report 1988	0.01	0.02
Canada thistle control - in hayland	Rolly View	D. Cole C. Richardson	Crop Protection Branch	On-going project Public Lands	0.01	0.02
Screening for smut resistance in barley	Olds	S. Slopek	Crop Protection Branch Co-operative project (within Alberta Agriculture)		0.35	0.35

WEED RESEARCH & DEVELOPMENT (continued)

PROJECT TITLE	TRIAL LOCATION	RESEARCHERS	AGENCY	STATUS AND REPORTED	PMY	TMY
Screening for bunt resistance in winter wheat	Olds	S. Slopek	Crop Protection Branch Co-operative project (within Alberta Agriculture)		0.05	0.05
Factors affecting the efficacy of Biomal	Olds	S. Slopek	Crop Protection Branch Co-operative project (within Alberta Agriculture)		0.00	0.00
Analysis of crop protection input interactions. Insecticides, fungicides, and pgr's.		Olds	S. Slopek Branch Co-operative project (within and outside Alberta Agriculture)	Crop Protection	0.15	0.35
Barley leaf disease loss assessment. Varietal differences, timing of application, effect of fertilizer.	Olds	S. Slopek	Crop Protection Branch Co-operative project (within and outside Alberta Agriculture)		0.20	0.15
Crop protection input efficacy enhancement.	Olds	S. Slopek	Crop Protection Branch Co-operative project (within and outside Alberta Agriculture)		0.05	0.05

WEED RESEARCH & DEVELOPMENT (continued)

PROJECT TITLE	TRIAL LOCATION	RESEARCHERS	AGENCY	STATUS AND REPORTED	PMY	TMY
Computer-assisted management of crop pests.		Olds	S. Slopek Branch Co-operative project (within and outside Alberta Agriculture)	Crop Protection	0.10	0.00
Diagnostic service for extension staff.	Olds	S. Slopek	Crop Protection Branch		0.08	0.05
Blackleg of canola survey.	Olds	S. Slopek	Crop Protection Branch Co-operative project (within and outside Alberta Agriculture)		0.02	0.00

Publications

ICAR SYSTEM SYSTEME IRAC

ESTAB/ETAN:. 20923

ALBERTA SPECIAL CROPS AND HORTICULTURAL RESEARCH CENTER

ICAR ID	PROJECT TITLE
61004254	Potato Cultivar Improvement - Clive Schaupmeyer
61004255	Potato Production Research - Clive Schaupmeyer
61004263	Bulb Crop Cultural and Cultivar Trials - Paul Ragan
61004265	Sweet Corn Cultivar Trials - Paul Ragan
61004266	Pea and Bean Cultural and Cultivar Trials - Paul Ragan
61004267	Cole Crop Cultural and Cultivar Trials - Paul Ragan
61004316	Weed Control in Pulses and Special Crops - Rudy Esau
61004319	Weed Control in Vegetable Crops - Rudy Esau
61004320	Weed Control in Nursery Crops and Shelterbelts - Rudy Esau
61004321	Weed Control in Potatoes - Rudy Esau
61006694	Studies on Diseases of Greenhouse Crops - Ron Howard
61006752	Sprinkler Irrigation on Management of Seed Alfalfa - Colin McKenzie
61006782	Diseases of Forage Crops - Ron Howard
62006784	Screening Potato Cultivars for Resistance to Early Blight - Jim Holley
61006792	Field Bean Cultivar and Cultural Trials - Refe Gaudiel
61006793	New Crops Cultivar Cultural and Adaptation Trials - Refe Gaudiel
61006794	Herbs and Spices Cultural and Adaptability Trials - Refe Gaudiel
61006795	Corn and Sorghum Cultivar and Cultural Trials - Refe Gaudiel
61006800	Vine Crop Cultivar and Cultural Trials - Paul Ragan
61009474	Chemical Weed Control in Small and Native Fruit - Rudy Esau
61009475	Bush and Native Fruit Culture and Cultivar Improvement - Lloyd Hausher
61009476	Nursery Production of Woody Ornamentals - Hannah Mathers
61009477	Annual and Perennial Flowers - Hannah Mathers
61009478	Woody Ornamentals - Hannah Mathers
61009485	Processing and Quality Evaluation of Potatoes - Nancy Crowe
61009487	Processing and Quality Evaluation of Vegetables - Nancy Crowe
61009488	Processing and Quality Evaluation of Fruit - Nancy Crowe
61009489	Native Fruit Utilization - Nancy Crowe
61009491	Culture of Greenhouse Vegetable Crops - Judy Butt
61009492	Evaluation of Hydroponic Systems for Growing Greenhouse Crops - Judy Butt
61009493	Solanaceous Vegetable Cultural and Cultivar Trials - Paul Ragan
61009494	Vegetable Mulch and Tunnel Trials - Paul Ragan
61009495	Perennial Vegetable Culture and Cultivar Trials - Paul Ragan
61009496	Culture of Greenhouse Floriculture Crops - Judy Butt
61009497	Root Crop Cultivar and Cultural Trials - Paul Ragan
84100555	Regional Woody Plant Hardiness Test Program - Hannah Mathers
84100557	Evaluation of Chemical and Biological Agents to Control Greenhouse Pests - Ron Howard

ICAR ID	PROJECT TITLE
84100558	Small Fruit Culture and Cultivar Improvement - Lloyd Hausher
84100559	Perennial Forages - Henry Najda
84100560	Cereal and Oilseed Regional Variety Trials - Henry Najda
86100790	Fairy Ring Eradication - Jim Holley
87000212	Water Management of Lentils - Colin McKenzie
87000213	Water Management of Safflower - Colin McKenzie
FFF 880276	Adaptability of Herbs, Spices and Essential Oils - Refe Gaudiel
FFF 890546	Salinity and Cold Tolerance of Ornamental Trees - Colin McKenzie
FFF 890555	Overwintering Container Stock - Hannah Mathers
FFF 890560	Commercial Adaptability of Essential Oils and Spice Crops - Refe Gaudiel

PUBLICATIONS

- "Guide to Range Conditions and Stocking Rates for Alberta Grassland". Co-authored with Lands & Forests and Field Crops Branch.
- "Varieties of Cereal and Oilseed Crops for Alberta 1988". Field Crops Branch.
- "Varieties of Perennial Hay and Pasture Crops for Alberta - 1988". Field Crops Branch.
- "Alberta Silage Manual". Field Crops Branch.
- Annual Report - Crop Research Section - Barley, Triticale, winter wheat breeding and agronomic research for the 1988 season. Field Crops Branch.
- "Field Pea Production Manual". Co-authored by Field Crops Branch.
- Guide to Crop Protection - Part I - Chemical - 1988. Crop Protection Branch.
- Control of Yellow Toadflax - 1988 - D. Maurice. Crop Protection Branch.
- Forage Weed Control Research Results (A compilation) 1978-1987. D. Cole and D. Peterson. 1988. Crop Protection Branch.
- Weed Control in Forage Legumes with Imazethapyr. N. Malik, D. Cole, L. Darwent, J. Moyer. 1988. Forage Notes 32 p. 42-45.

FACT SHEETS

681-1-1989	Control of Beaver Damage. Crop Protection Branch.
688-11-1988	Control of Porcupine Damage. Crop Protection Branch.
FS684-12-1988	Control of Rabbits and Hares. Crop Protection Branch.
684-13-1989	Bat Management. Crop Protection Branch.
682-1-1989	A History of Rat Control in Alberta. Crop Protection Branch.
450-684-1989	Prevention of Predator Damage in Poultry Flocks. Crop Protection Branch.
100/32-1	Irrigated Crop Recommendations for Alberta 1989-90. R. McKenzie, B. Roth and B. Shaw.

FACT SHEETS (continued)

120/32	Varieties of Perennial Hay and Pasture Crops for Alberta. AFAC. Revised. Alberta Special Crops and Horticultural Research Center.
258/642-1	Guide to Weed Control in Potatoes. Alberta Special Crops and Horticultural Research Center.
127/15-2	Timothy Seed Production in Alberta. K.J. Lopetinsky, D. Cole, M. Okuda, L. Darwent. 1989.
127/15-3	Meadow and Creeping Foxtail Seed Production in Alberta. K.J. Lopetinsky, D. Cole, M. Okuda, L. Darwent. 1989.

ASCHRC PAMPHLET SERIES

89-13	Greenhouse Research Program.
89-7	Report of Feed Processing and Quality Evaluation Program.
88-14	Weed Control Trials, 1987.
89-6	Fruit Crop Trials.
89-10	Plant Pathology Program Research Report.
88-18	Entomology Program Research Report.
88-8	The Southern Alberta Regional Crop Laboratory Report.
89-15	Alberta Potato Industry Cultivar Trials.
89-2	Ornamental Research Program.
89-3	Woody Ornamental Plant Trials.
88-1	Soil and Water Agronomy Research Report.
88-9	Field Crops Cultural and Cultivar Trials.
88-13	Alberta Saskatoon Industry Survey.
88-15	User Documentation for the Fungicide Information Retrieval System (FIRS) Version 2.1.
88-16	User Documentation for the Fungicide and Fumigant Information Retrieval System (FFIRS) Version 2.2
88-17	User Documentation for the Fungicide and Fumigant Information Retrieval System (FFIRS) Version 3.0.

ASCHRC PAMPHLET SERIES (continued)

89-1 Golden Prairie Arboretum.

88-12 Forever Green Pinetum.

Potato Questions and Answers.

Smaller Seed Tubers, Key to Increased Yields.

1989 Hybrid Recommendations List. Alberta Corn Committee Publications.

NEWSLETTERS

- HEN (Horticulture Extenstion Notes) - 7 issues
- Alberta Horticulturist - 4 issues
- Alberta Nursery Notes - 4 issues
- Alberta Greenhouse Notes - 10 issues
- Alberta Produce Notes - 6 issues

TECHNICAL MEMO

- #8 - Registration - Assert 300LC
- #10 - Registration - Excel
- #11 - New Registration - Reglone

SCIENTIFIC PAPERS

Crowe, N.L. and V.F. Rasper. 1988. "The Ability of Chlorine and Chlorine-related Oxidants to Induce Oxidative Gelation in Wheat Flour Pentosans." J. Cereal Sci. 7:283-294.

Crowe, N.L. 1988. "Effect of Chlorine Compounds and Other Oxidants on the Oxidative Gelation and Cake Baking Properties of Wheat Flour Pentosans." Ph.D. Thesis, University of Guelph, Guelph, Ontario.

Huang, H.C., L.M. Phillippe, R.J. Howard and E.R. Moskaluk. 1988. "Survey of Verticillium Wilt of Alfalfa in Southern Alberta." Can. Plant Dis. Surv. 68(1):63-64.

Bains, P.S., H.R. Pappu and C. Hiruki. 1988. "An Improved System for Clover Yellow Mosaic Virus Infection of Pea Leaf Mesophyll Protoplasts." Ann. Phytopathol. Soc. Japan. 54, 174-182.

SCIENTIFIC PAPERS (continued)

Bains, P.S. and J.P. Tewari. 1988. "The Host-specific Toxin Produced by Alternaria brassicae Isolations Chemical Characterisation and Mode of Action." Internatl. Conf. Res. Plant Sci. and its Relevance to Future, University of Delhi, India, March 7-11, 1988. (Abstr.)

Tewari, J.P. and P.S. Bains. 1988. "Mode of Action of the Host-specific Toxin Produced by Alternaria brassicae." 5th International Congress of Plant Pathology, Kyoto, Japan, August 20-27, 1988. (Abstr.)

Pruski, K., M. Mohyuddin and G. Grainger. 1988. "Saskatoon (Amelanchier alnifolia) NUTT. in Biotechnology of Agriculture and Forestry." Ed. Y.P.S. Bajaj, Springer-Verlay, Berlin.

EXPERT COMMITTEE ON WEEDS RESEARCH REPORTS

Western Canada Section

Control of Scentless Chamomile in Established Alfalfa. D.E. Cole, K. Heier. 1988. ECW Res. Rep. West. Sect. Vol. 3, p. 2.

Tolerance of Seedling Legumes to Herbicides. Cole, D.E., K. Heier. 1988. ECW Res. Rep. West. Sect. Vol. 3, p. 3.

Tolerance of Seedling Grasses to Herbicides. D.E. Cole, K. Heier. 1988. ECW Res. Rep. West. Sect. Vol. 3 p. 37.

Tolerance of Established Grasses to Herbicides. D.E. Cole, K. Heier. 1988. ECW Res. Rep. West. Sect. Vol. 3 p. 39.

White Cockle Control in a Mixed Forage Stand. D. Cole, K. Heier. 1988. ECW Res. Rep. West. Sect. Vol. 3 p. 112.

Second Year White Cockle Control in Red Clover. D.C. Maurice, D.E. Cole. 1988. ECW Res. Rep. West. Sect. Vol. 3 P. 113.

Toadflax Control in Established Alfalfa and Bromegrass. D.E. Cole, K. Heier. 1988. ECW Res. Rep. West. Sect. Vol. 3 p. 128.

Comparison of Products for Chemical Fallow. D.E. Cole, K. Heier. 1988. ECW Res. Rep. West. Sect. Vol. 2 p. 421.

- Wild Tomato Control in Dry Beans. R. Esau, B. Krause.
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